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TELEPHONE ENGINEER

VOL. 29, NO. 2 FEBRUARY, 1925 CHICAGO

Would You Drive a 1905 Automobile?

OF course you would not care to drive a car that was built twenty years ago. It could not use today's grade of fuel. Tires and other equipment would be out-of-date. In short it would not deliver the service you expect and want under today's conditions.

Conditions have changed in the telephone field too. You cannot give the high grade service demanded today with equipment built to meet yesterday's needs.

Changed conditions, different modes of living, a different generation, call for a different sort of service. Quicker, more accurate connections are needed.

Strowger Automatic not only delivers this kind of service but affords insurance against obsolescence. Service in a Strowger Automatic exchange will always be up-to-date because the equipment is easily adjustable to changing requirements, and in making additions advantage can always be taken of the latest developments.

The "old way" of setting up telephone connections is fast giving way to the "new way," the Strowger Automatic way. Large and small operating organizations all over the world are finding the "new way" more profitable.

STROWGER AUTOMATIC

REG. U. S. PAT. OFF.

Automatic Electric Company

FACTORY AND GENERAL OFFICES: CHICAGO, ILLINOIS

ASSOCIATED COMPANIES

International Telephone Sales and Engineering Corporation.....New York
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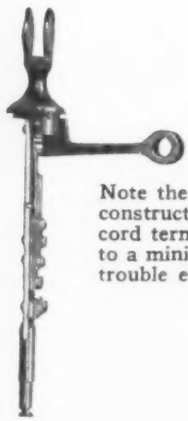
FOR REAL SERVICE

The No. 113 Desk Stand

MAGNETO OR COMMON BATTERY

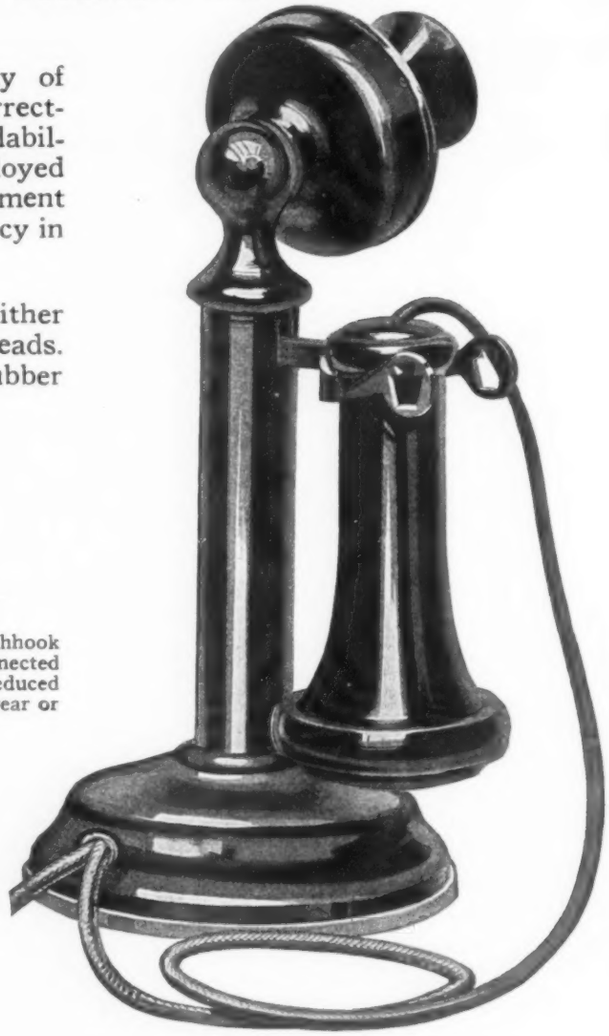
Sturdy Construction, Simplicity of Mechanism, and Electrical Correctness Spells Economy and Dependability. Standard apparatus is employed throughout, making this instrument practically unexcelled for efficiency in service.

Stands are supplied with either solid or adjustable transmitter heads. Base is equipped with Burns Rubber Cushion.



IN THE STEM

Note the simplicity of the Switchhook construction and the direct connected cord terminals. Equipment is reduced to a minimum and all possible wear or trouble eliminated.



Secure satisfied subscribers by installing THESE "tested and proven" TELEPHONES.

Prices and detailed information furnished on full line of SWITCHBOARD and TELEPHONE equipment.

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Burns Loud Speakers and our Radio Head Telephones Have Proven exceptionally popular—They are built by telephone experts.

A stock of our standard equipment is carried in stock by a distributor in your territory

American Electric Company

CHICAGO, U. S. A.

FOR OVER 30 YEARS MAKER OF GOOD TELEPHONES

TELEPHONE ENGINEER, February, 1925. Volume 29, No. 2. Published monthly by TELEPHONE ENGINEER. Publication Office, 28 E. Jackson Blvd., Chicago, Ill. Subscription price $2 a year in the U. S. Entered as second class matter June 6, 1922, at the Post Office at Chicago, Ill., under act of March 3, 1879.

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Vice-Pres.

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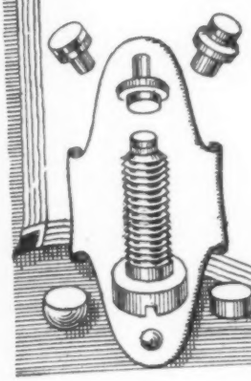
We buy platinum scrap, basing our returns upon actual assay. For this we pay cash or send you refined platinum in any desired form.



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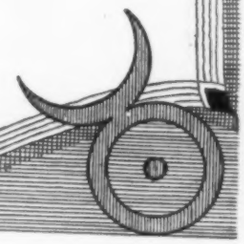

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Telephones Are Guaranteed

The long service, durable construction and pleasing finish of Federal Standard Telephones have given satisfaction to thousands of users the world over. Built into every Federal Standard job is the exhaustive experience of over twenty years of scientific telephone construction. Made of the finest materials, mechanically and electrically perfect and treated to prevent destruction by attacks of insects, rust or corrosion, artistic in appearance, and guaranteed flawless in operation.

Federal Telephone and Telegraph Co.
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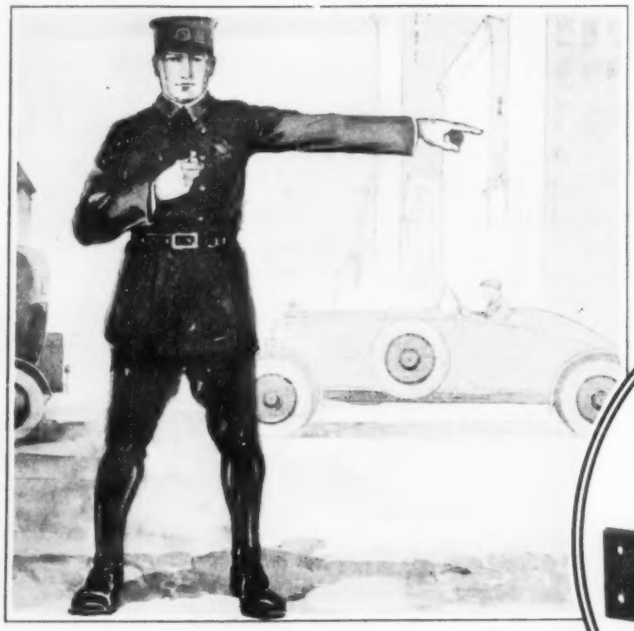
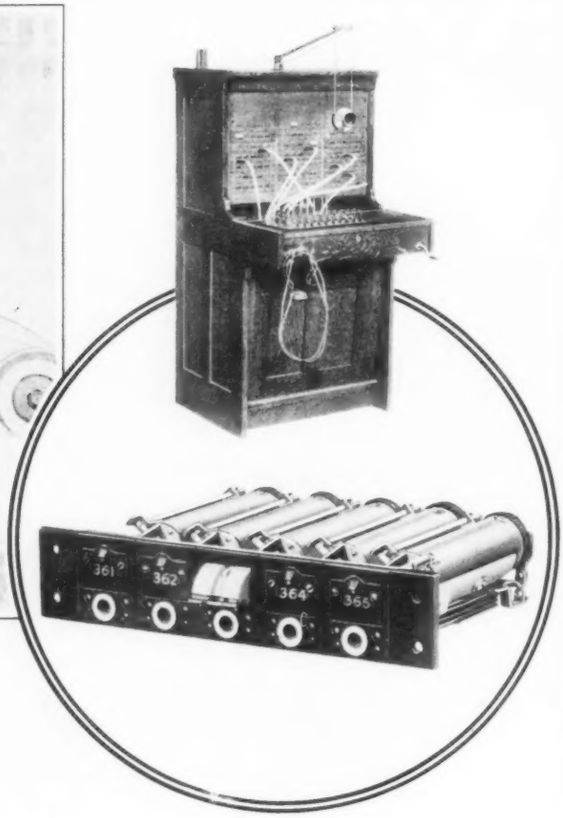
Stromberg-Carlson





The Stromberg-Carlson No. 105 Switchboard Brings:

Keyboard Supervision

Automatically Restored Supervision

Double Supervision

Positive Supervision

Aligned Supervision

Non-Ring-Through Cord Circuits

Repeating Coil Cord Circuits

Automatically Restored Line Signals

Removable Number Plates

Low Key Shelf

Multi-faced Drop Shutters

Duratex Cords

Conspicuous Signals

A traffic officer depends on the conspicuousness of his signals when guiding the traffic at congested street intersections.

He knows, that only distinct signals will be interpreted properly by the masses of drivers.

The necessity of distinct signals is equally essential in the modern magneto telephone exchange.

Here the operators must know at all times where their services are required—and furthermore, they must know instantly—what action is necessary on their part.

Such knowledge is provided by the signalling apparatus that is furnished as regular equipment on the Stromberg-Carlson No. 105 Magneto Switchboard.

On this switchboard the multi-faced shutter of the line signal is conspicuous from every angle and the supervisory signals are mounted down on the keyboard in plain view to the operators—not behind an entangled mass of cords

Bulletin No. 118 Fully Describes the No. 105 Switchboard.

Stromberg-Carlson Telephone Mfg. Co.

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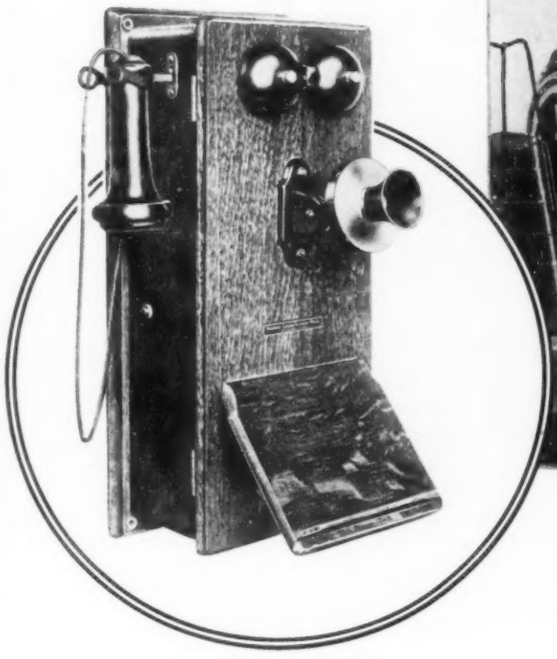
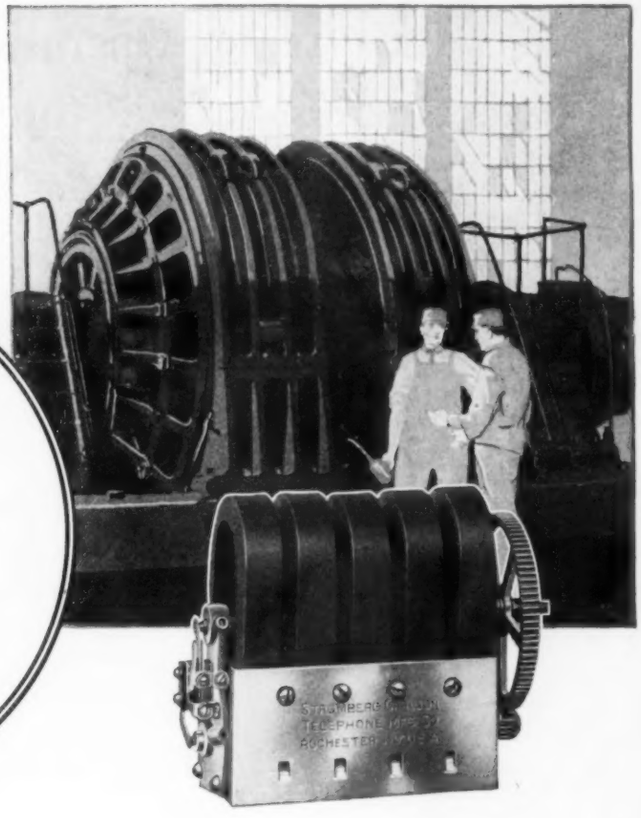
Stromberg-Carlson





The Stromberg - Carlson No. 896 Magneto Telephones are provided with—

- High Efficiency, Low - Battery Consumption Transmitters
- Sensitive Receivers
- Powerful Generators
- Duratex, Brown Silk Cords
- Universal Wiring
- Braided Insulation
- Bakelite Parts
- Convenient Writing Shelf
- Durable Finish
- Cabled Wiring
- One Screw Type Ringer Adjustment
- Detachable Hookswitch
- Short Transmitter Arm

A Generous Generator

From the very first wet battery type magneto telephones of years ago and up to the present No. 896 Magneto Telephones, Stromberg-Carlson Magneto Telephones always have been equipped with powerful generators.

The object has been to provide a telephone which would not only talk, but signal over any worth while line.

Stromberg-Carlson Generators are one of the big reputation-building factors of the No. 896 Magneto Telephone.

These generators are designed to furnish a surplus of ringing current with ample voltage at all loads, to be easy to operate, to turn smoothly and quietly and to be long-lived.

They are regular equipment in the following No. 896 Types of Magneto Telephones:

Code No.	896-R	— 3 Bar,	1000	Ohm	Bridging
" "	896-I	— 5 "	1600	"	"
" "	896-L	— 5 "	2500	"	"

Bulletin No. 114 Fully Describes the No. 896 Magneto Telephone

Stromberg-Carlson Telephone Mfg. Co.

FACTORY and GENERAL OFFICES—ROCHESTER, N. Y., U. S. A.

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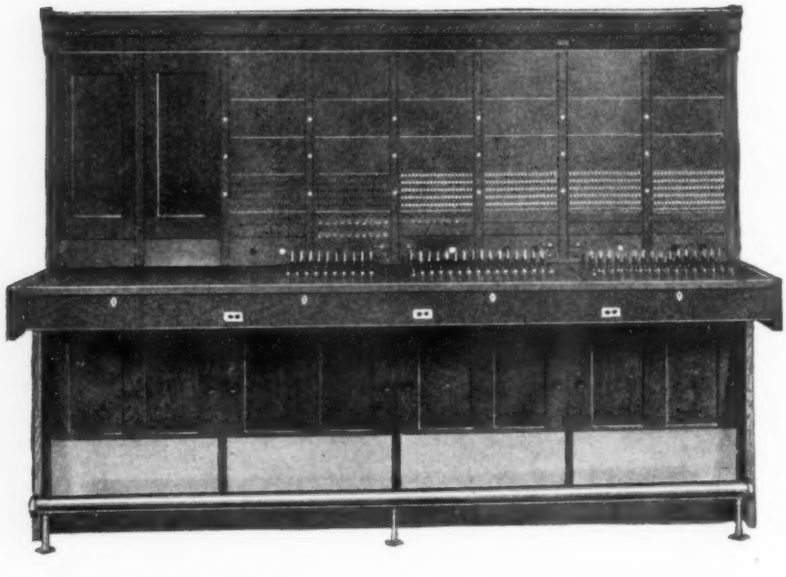
Charleston Electrical Supply Company, Charleston, West Virginia

8 Features for the Greater Operating Efficiency of the New Monarch Sensible Switchboard



1. The Universal cord circuit eliminates all trunk circuits between operators and allows all magneto and common battery lines to be multipled into each position.

2. When the magneto subscriber rings for service or for disconnection the operator is signaled by a flashing lamp instead of a permanent signal.

3. The Ringing Tone can always be heard by the calling party assuring him that his call is being carried through.

4. Machine Ringing is provided on all common battery connections.

5. The calling subscriber controls the machine ringing.

6. During the time of ringing and talking the keyboard is dark until one or both subscribers hang up, again lighting the supervisory lamp until the plug is removed.

7. The Audible Busy Test is provided enabling the operator to know when a line is busy.

8. Emergency ringing is provided at all times whether the interrupter operates or not.

For more detailed description of these features send for our Bulletin No. 63.

Monarch Telephone Mfg. Co.

1027 WEST VAN BUREN ST., CHICAGO, ILL.

Twenty years of development in *actual service* is the endorsement of the

Runzel - Lenz Moisture - Proofed Tinsel Switchboard Cord

This Runzel-Lenz switchboard cord is the product of the greatest research and development laboratory in the world—actual service of twenty years.

In 1905 we introduced the moisture-proofed tinsel switchboard cord. It has been under our close surveillance ever since. There have been refinements made in this cord, and some slight changes in construction. Every detail that has been changed from the original construction was altered because of some reason revealed by the hard work at the board.

Constant jerking and twisting—perspiration from the darting hands of operators working under hot and stuffy conditions that are rarely found today—the demand for lower eventual cost—all of these factors figured in the perfection of the Runzel-Lenz moisture-proofed switchboard cord as you find it today.

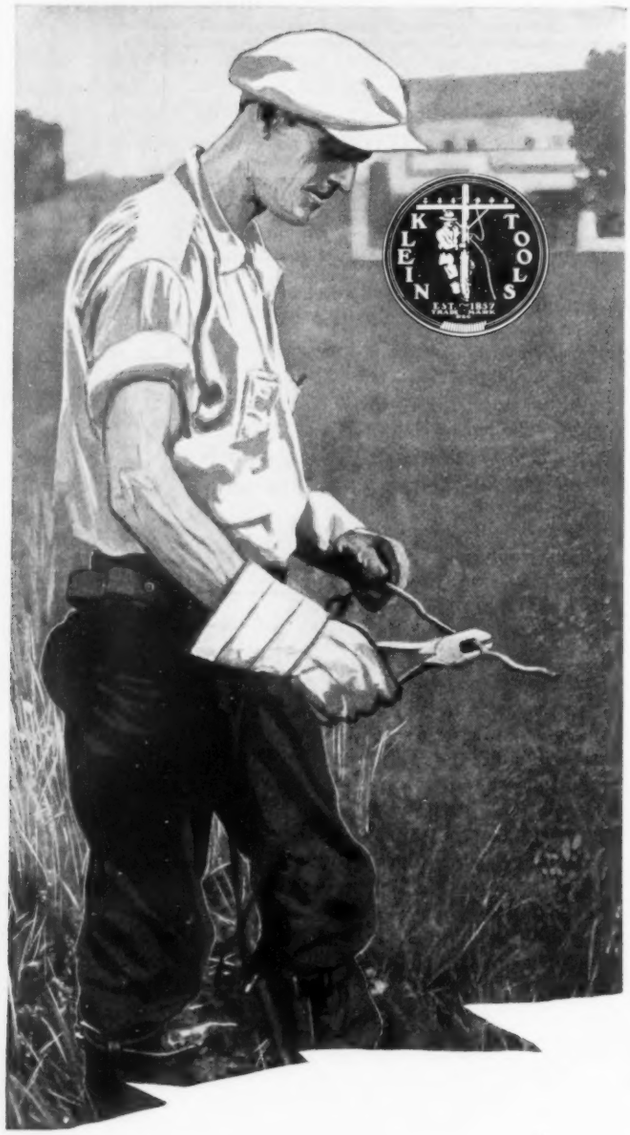
So now you have something about the background of this superior cord. You see why this cord so brightly shows the benefits of specialization in cord research, cord designing, cord making, and checking-up on cord performance.

Try the Runzel-Lenz moisture-proofed tinsel switchboard cord, and see for yourself how twenty years of constant attention has made it the best buy in the cord business.

Runzel-Lenz Electric Mfg. Co.

Switchboard and telephone cord specialists

1751 N. Western Avenue
CHICAGO, ILL.



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You will find them in the tool belts and kits of linemen and mechanics who are skilled craftsmen. Powerful leverage, keen reinforced cutting knives, comfortably shaped.

Klein's are rugged pliers for the tough job!

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150,000,000 Ft. B. M. Annually

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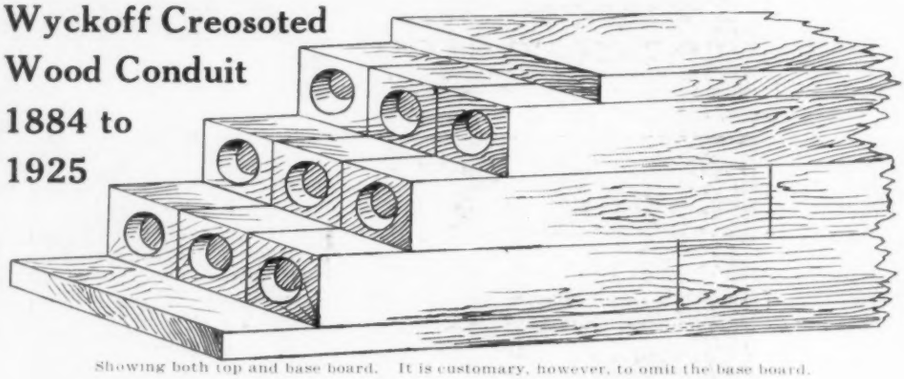
Wyckoff Creosoted Wood Conduit 1884 to 1925



Showing both top and base board. It is customary, however, to omit the base board.

The U. S. Gov't says, in reference to the Creosoting Treatment: —"The EFFICIENCY of treatment depends on three things:— The amount of Creosote — its character, and the thoroughness with which the timber is penetrated."

All creosoted wood conduit, advertised as having been used or in service from 20 to 42 years, or over, refers to the service of WYCKOFF Creosoted Wood Conduit ONLY, and as made by this company.

We have been making WYCKOFF Creosoted Wood Conduit since ***1884***—We were its ***original inventor***—were protected by ***patents*** and were the ***sole manufacturer*** for years and have today over sixty million lineal feet in service, with ***not a single failure.***

Each year, since 1884, we have utilized our previous experience and engineering knowledge gained, by making better conduit. We know how to make it for PERMANENCY and FREEDOM FROM DECAY. It will give you satisfaction. Address

The Wyckoff Pipe & Creosoting Co.

GENERAL CREOSOTERS

522 FIFTH AVENUE **NEW YORK CITY**

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TRADE MARK REGISTERED
GRAY LABEL
DRY CELL
FOR TELEPHONE
SERVICE
This dry cell combines both quality and service in the highest degree. Its quick recuperative power guarantees the greatest efficiency, reliability and long life for telephone use.
NATIONAL CARBON CO. Inc.
NEW YORK, N. Y.
ATLANTA, CHICAGO, CLEVELAND
KANSAS CITY, LONG ISLAND CITY, SAN FRANCISCO
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POSITIVE TERMINAL IN CENTER
GCR

COLUMBIA Gray Label Batteries never fuss or fume. When the subscriber jiggles the hook, they just snap in and out of action, calmly and quietly. Heavy service suits them just as well as prolonged idleness. Hang up the receiver and they drop back into complete rest, recuperating their strength. No matter how much or how little they are used, Columbia Gray Label Batteries cost less per month of service. Fahnestock spring clip binding posts at no extra cost to you.

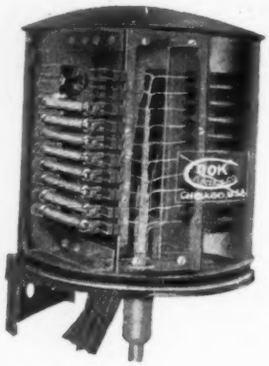
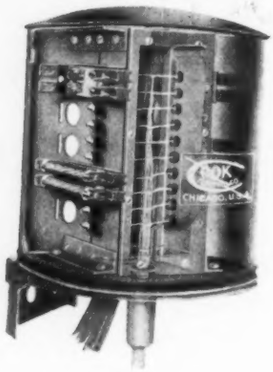
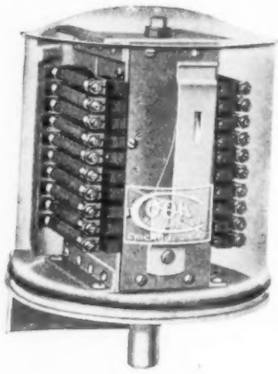
Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

Columbia Telephone Batteries

Best by test—they last longer

Cook All Steel Protected Terminals Withstand Every Climatic Condition

There Is No Wear—Rot or Check To Cook All Steel Protected Pole Cable Terminals.

The All Steel Construction Guarantees Satisfactory Service Years and Years Longer Than Similar Terminals Made of Wood and at No Additional Cost.

COOK ELECTRIC CO.
2700 Southport Ave.
CHICAGO

TELEPHONE ENGINEER

VOLUME 29 FEBRUARY, 1925 Number 2

FINANCING REHABILITATION IN ILLINOIS.

The general order of the Illinois Commerce Commission, obtained through the efforts of the Illinois Telephone Association and its secretary, Jay G. Mitchell, affords means of obtaining relief for those telephone companies which suffered severely from the December sleet storm. This appeals to us as a sensible and logical method of financing the expense of rehabilitation and of restoring service to the public. Ordinary methods of computing depreciation and the ordinary schedule of making replacements do not take into account the possibility of a large portion of the plant being destroyed within a few hours. When such a casualty occurs, the fact that adequate provision had been made for replacement of the ordinary kind, affords no relief. The immediate problem is to secure funds to restore service and to secure them, quick.

Under such conditions, usually, the only means of securing funds available is to borrow. But, funds can not be borrowed unless there is some assurance that the interest will be met and the principle paid when it falls due. The margin between revenue and expense of the ordinary telephone company, operating in a restricted area, will not give this assurance, especially at a time when its plant consists largely of tangled wires and broken poles and cross arms. When this is the situation, the authority to issue bonds or notes is not sufficient. There must also be provision for repayment and this provision can only be made by increased revenue.

The Illinois commission has very wisely provided for the increased revenue by allowing the companies to file an increased rate schedule and it has adequately protected the subscribers by ordering that the revenue produced by the increase in rates shall be used for retiring the borrowed capital and for no other purpose. This order should make it possible for the Illinois companies to secure funds and to restore their properties in a minimum of time.

The telephone companies of Illinois and their subscribers are to be congratulated upon the fact that they have at their service a live telephone association with an energetic secretary to whom much of the credit of securing this order must be given. No less should the be congratulated upon the fact that they have a regulatory body made up of men who can rise to an emergency and authorize a method of relief whereby may be minimized the usual delays and inferior service that usually follow widespread sleet damage. The Illinois plan is one that other states will do well to follow.

THE MUTUAL PROBLEM AGAIN.

The subject of the mutual telephone line, one of perennial interest to telephone men, becomes of increasing interest now that many are favoring the opinion that some kind of mutual organization is one of the practicable methods of assuring telephone service in communities where the operation of an exchange would not be practicable as a commercial venture.

The mutuals of the past have been failures due to two things, lack of intelligent management and rates that are entirely inadequate to maintain the plant properly. In many cases the two things have gone together because the lack of revenue is the reason why a suitable man could not be employed to maintain the plant.

If the mutual organization is to come back as the means of operating the plant that is too small to be a profitable commercial enterprise, some way must be found to assure the upkeep of the property so that the experience of failure will not be repeated. State association officers and managers of neighboring commercial exchanges occasionally have the opportunity of assisting in the reorganization of these mutual properties and one of their greatest difficulties is finding the way to avoid this contingency.

Since the difficulty arises largely from the unwillingness of the mutual shareholders to contribute a sufficient amount, the solution must be arrived at by convincing him that the system must have adequate funds if it is to give good service. Secretary J. G. Ihmsen of the New York Upstate Association has been successful in working out this problem with a number of companies and the method employed

was described at the last national convention. Since the method may be applicable in other states, reference to it may be helpful.

In many states, the farmers are familiar with a mutual form of insurance in which each contributes a stated sum and at the end of the year, any surplus remaining is returned either as a dividend or as a credit on the payment for the next year. Secretary Ihmsen's plan took advantage of this familiarity and a similar scheme was proposed for the mutual telephone system. The experience of neighboring commercial companies was taken and a nominal rate of $1.50 or $2.00 per month was established. After the business of the year is closed the surplus, if any, is applied as a dividend.

Little difficulty was found in making the farmer members understand the system of payment and it has the advantage of providing funds without the necessity of levying assessments, with the attendant possibility that the assessment will be made only large enough to pay immediate expenses. As yet we have no data upon the final success of the plan but it has the advantage of playing upon the peculiar kink of human nature that will make a man consent to pay more when there is a chance of getting something back than to pay a smaller amount when he is certain that nothing will be returned.

SOME TECHNICAL LESSONS FROM THE SLEET STORM

The sleet storm that swept across the central west during the week of December 18th. was, probably, the most destructive that ever has visited that portion of the country. At the time this is being written, six weeks later, there are still thousands of poles that have not yet been replaced and large numbers of telephones still out of service. In some respects the storm was unusual, as in many places it was accompanied by little or no wind. The duration of the precipitation was greater than usual and the temperature remained about constant —near the freezing point— throughout the period. Wires accumulated coatings of ice to a radial thickness of from three-fourths to one inch, and in addition icicles several inches long formed close together along the wires. In some places the ice remained on the wires as long as eight days.

Such a storm only is to be expected once in a generation and a study of its effect gives much information that is not obtainable from other storms, covering smaller areas or involving lighter coatings of ice. TELEPHONE ENGINEER has received many letters and has accumulated a considerable amount of information which can not be reproduced in full, both on account of their length and the fact that some of the writers have expressed opinions which they have asked us to refrain from publishing. However, it is permissible to review some of the experiences and conclusions that have been drawn by men who have been in actual contact with the work in the storm area.

In the first place, there seems to be some question as to the practicability of providing sufficient strength of pole line to withstand the load experienced during this storm, where the line carries four or more cross arms. Such a storm occurs, perhaps, only once in the lifetime of a pole and it is an open question as to whether a line built to withstand such loading would be the cheapest in the long run.

As has been shown in other storms, failures of lines commence at weak points and terminate at points where the lines have sufficient strength. Apparently there were more failures due to poles pulling out of the ground than has been the case in other storms. This condition has been reported by a number of our correspondents. The usual weak spots at the ground line of poles, where decay has taken place, caused many failures. Insufficient trimming of trees where the wires were overhung by large trees also was the cause of numerous initial failures which caused long sections of line to go down.

In this storm, the usual form of storm-guyed pole, anchored in four directions, in many cases failed to withstand the strain. These poles failed, either through the breaking of guys or the buckling and breaking of the pole itself. On the other hand, H fixtures pretty generally stood up under the load, although the line may have gone down on each side. One correspondent records the fact that the failures of long lengths of line stopped at places where four or five good poles were close together. He suggests that this fact may be taken advantage of in future work on lines by making the pole replacements in groups rather than as scattered poles along the lines.

The lessons of other sleet storms are emphasized rather than changed by this storm. Damage can not be prevented entirely, but it can be minimized by certain measures. Among these are: Lines built closer to the ground; poles of adequate strength—particularly with heavy butts, or of high strength timber; preservative treatment to prevent weakening at the ground line by decay; well-built corners, and on important lines, storm guying or H fixtures at intervals along the lines; lines well trimmed out, especially where trees overhang the line. With the data of this storm available, it is to be hoped that our outside plant engineers now will be able to give us the design for the most economical line of adequate strength.

Service and Collections

Good Service and Collections Are Inseparable, Is Opinion of the Writer of This Article—Given Good Service, He Outlines Collection Routine That Gets Results

By W. E. HUTCHENS

Commercial & Traffic Superintendent, The United Home Telephone Company, Muskegon, Michigan

The Traffic Department of a telephone company is taught in the beginning, and is constantly reminded of the fact, that its one great duty is to render service. This is as it should be, but we sometimes wonder if other departments have a comprehensive understanding of the term "service," or does its meaning end with the work of the Traffic Department?

Are we to understand that this term applies only to the establishing of connections at the switchboard? If so, then our knowledge of the term is, without question, superficial. Of course the establishing of connections does not include all that is meant by "service," we say that as applied to traffic operation, for the voice, the attitude and general demeanor enter into it largely.

This may also be said of the service rendered by the Plant Department. The fact that the repairman or the installer completes the work assigned in a prompt and workman-like manner is not enough. What impression of his company has been left in the mind of the subscriber? Did the workman render a full service or was the mechanical work the only service rendered? What about his attitude?

The term "service" is big enough to cover every transaction of every representative of the company, from the janitor to the president. A very important part of the service which can be rendered the telephone user, is that which should be rendered by the Commercial Department.

What can be done in this department that the patron may receive the greatest service possible?

Usually collection of rental and long distance charges is the bug-bear of the Commercial Department. Why? The answers obtained through a study of conditions at various exchanges might vary, but an analysis of conditions usually shows an intimate relation between collections and quality of service.

If you want to know the kind of service a telephone company is rendering; whether the manager has a thorough understanding of his requirements, ask him, "How is business?" If he replies that so many telephones were installed last month, mark it well, he has not yet scratched the surface of his duties as manager, but if he replies that his collections are in good condition, he has at least sensed the purpose for which he is employed; viz, to render service.

This does not mean that to have collections in good condition is all that is to be considered, but it does mean that the condition of the collections is the barometer of the class of service rendered.

The public will have telephones installed whether the service is good or not, but it will fail to pay promptly and in full when the service is poor.

Good Service Is Essential to Good Collections

When the service is poor, collections are invariably in the same condition, therefore the first requirement is good service—service that when rendered, you can look the public in the face and demand your pay.

The most useless piece of equipment in a telephone exchange is a collector, and making collections with a 100 per cent efficiency should be the easiest task that the exchange should encounter. How can it be done?

First there must be provided a plant in good condition, and the best type of equipment known should be employed, and a policy of proper maintenance strictly and promptly adhered to.

Next, a thorough organized Traffic Department, trained in courtesy, accuracy and speed, as well as a thorough knowledge of operating routine is absolutely necessary.

When these things have been provided and efficiency in the Traffic Department is firmly established, a first class service can be rendered.

Now the Commercial Department comes into the picture and attempts to collect for this service. In most instances a strict policy is outlined for the department to follow, but sometimes no fixed policy is known.

A Practical Collection System

It is an easy matter to theorize, so instead of presenting these ideas from a purely theoretical view, let us give you the history of this problem as worked out by a real company, doing a real business—a company that can boast of approximately 100 per cent each collection period.

This company renders statements for rental quarterly in advance, allowing one month for payment if the discount is to be taken. Care is used in seeing that each subscriber is properly billed, the addressograph being used for this purpose.

At the close of the first month of the quarter, second notices are sent to all who have not paid and ten days permitted to elapse before the service is discontinued. If any accounts are unpaid at the expiration of this time, the instrument is promptly disconnected. If the account is then paid, a reconnection charge of $1.50 is made.

Before this plan was placed in operation, an educational campaign was carried on. Conditions were explained, the reason for every part of the plan was given, and the co-operation of each subscriber was requested. The campaign was designed to show the subscriber that it was unfair to ask him to pay for his service promptly at a specified time, if accounts of others were carried; that the company had a real desire to render to each individual subscriber a real service and that carrying unpaid accounts on the books prevented it from so doing; that if such a condition were permitted to exist, so great would be the loss because of bad accounts and increased overhead costs that, in time, they as paying subscribers would eventually be required to pay this loss in increased service rates.

The Disconnect List Disappears

The response was almost unanimous and it is a rare thing and has been for a number of years to see a "disconnect list" at any of the exchanges of the system. At the end of each year the loss from unpaid balances for service terminated is infinitesimal. All of this tends to show that, as far as the public is concerned, education along these lines is all that is required to secure results. Having a comprehensive knowledge of the terms and conditions attached to an application for service, the public gladly adheres to this routine for its own personal good.

When an application for service is received, those conditions are explained so that no misunderstanding will later arise, and when the final day for payment arrives the policy is strictly adhered to and no favoritism is shown.

Such a method may be classed as harsh by those who look upon it from a single

viewpoint, but a severe analysis of the method as it is applied shows the reverse to be true.

We may maintain our plant to its highest efficiency, we may carry our traffic load to the entire satisfaction of the public, but if we fail to make collections in a proper manner and with as great an efficiency as is required in the other departments, we have dismally failed to render a first class service.

"By their collections, shall ye know them."

Minnesota's Meet Lively

Annual Convention Is Attended By 350—Practical Talks Feature Program.

St. Paul, Minn.—The "experience meeting" motif of Minnesota telephone meetings, which was nurtured during the past year by 17 district conferences hit its crescendo in the 16th annual convention of the Minnesota Telephone Association, which was held at the St. Francis Hotel here.

Lively discussions sprung up all through the meeting, inspired by a number of addresses of an intensely practical character.

What the Minnesota telephone companies face in taxation was outlined by Secretary Charles E. Hall of the Northwestern Bell. The taxation problems and other legislative perils represented one of the serious difficulties the Minnesota men wrestled with at the convention. Switching service costs as covered by H. E. McWethy proved one of the very interesting details of the program. He showed importance of the problem of determining equitable switching rates. In Minnesota, Mr. McWethy said, there are approximately 42,000 connecting line subscribers. This is 10 per cent of the total number of telephones for the state, or 16 per cent of the telephones outside of the cities of Minneapolis and St. Paul.

He commented on the wide divergence in the cost of furnishing switching service. A study made by the Tri-State company in 1919 at 11 exchanges revealed a variation from $3.40 to $13.20 per year. Mr. McWethy stated that his experience has shown even wider variations.

This wide divergence in the cost of this service, he said, makes it important to each company that it know definitely, from a thorough analysis, its cost of producing switching service.

Mr. McWethy gave the major elements to be considered in an analysis of switching rate costs, including a valuation of the property jointly used by the local company and the switched lines, operating expenses involved in the production of switching service, apportionment of rent, traffic, commercial and general expense.

"Trees on Highways," a subject covered by E. J. McGrath of the Northwestern Bell, the paper on "Self-Corrosion of Lead Cable Sheath," by Professors Anderegg and Achatz of Purdue, a paper on "Telephone Directories," presented by W. T. Leyden, and papers on the benefits of district conferences, read by Miss Adelaide Theimer and Miss Edith Yust, were other program features.

Other of the principal speakers were G. R. Martin, executive vice-president of the Great Northern Railroad, C. C. Deering, Mayor Arthur E. Nelson of St. Paul, L. G. Grewe of the Gopher Mutual Casualty Company and O. W. Kolshorn of the Farmers' Mutual Insurance Co.

The convention endorsed a committee report recommending a universal rural fire-alarm call.

All of the officers whose 1924 administration had proved so satisfactory to the association, were re-elected.

The Minnesota official roster: D. M. Neill, president; E. P. Wright, vice-president; J. C. Crowley, Jr., secretary-treasurer.

Antiquated Rates Sore Spot—South Dakota Seeks Cure

Aberdeen, S. D.—South Dakota telephone men tackled the rate restriction that is seriously hampering attempts to make a profit in the operation of telephone plants at the 19th annual convention of the South Dakota Telephone Association. Chairman W. G. Bickelhaupt of the legislative committee discussed the situation in detail with special attention paid to settlements between connecting companies and the statutory service station switching charge of 25 cents a month fixed by the legislature in 1909 and still in effect.

George W. Robinson, president of the Tri-State gave some practical pointers on finances.

Other high lights of the program were the addresses of Charles E. Hall of Omaha on the "Reminiscences of a Telephone Pioneer," "Pole Preservation," by S. G. Harris, of Page and Hill, "Switchboard Installation and Maintenance" by Jay Houghtaling of Kellogg's, "Exchange Construction" by W. F. Heath of the Northwestern Bell, and "Accounting for Small Exchanges" by H. A. Livermore of the Northwestern Bell. A paper on "Connecting Company Relations" presented by W. R. Johnson, general manager of the Dakota Central, also was one of the convention features. Relations between telephone and power companies were discussed by O. E. Rofelty, manager of the Northern States Power Company.

W. W. Straight of Crooks was elected president for the ensuing year. Other executives elected were: Vice-president, W. C. Nesbit, Dell Rapids, and secretary-treasurer, Thomas Phalen, Aberdeen.

Directors—J. A. Steninger, Parker; J. J. Bollinger, Bridgewater; M. E. Guinter, Sioux Falls, and L. H. Snyder, White Lake.

Bell Buys Gary Control of Kansas City Company

Kansas City, Mo.—Ownership of the Kansas City Telephone Company, acquired by the Theodore Gary interests in 1912 passed into the hands of the Southwestern Bell Telephone Company on January 15.

E. D. Nims, president of the Southwestern Bell company, succeeds Arthur F. Adams as chairman of the board of directors of the Kansas City Telephone Company, and A. B. Elias, of St. Louis, becomes president of the company, succeeding Hunter L. Gary.

J. G. Crane, vice-president and general manager of the company for the Gary interests, remains as vice-president and head of the operating department and will be a member of the new board of directors.

It was announced that there will be no change in the local personnel of the company, and that the building program will be continued as originally planned. This program looks ahead for five years, and contemplates the addition of approximately 7,000 stations a year as well as extensive automatic equipment installations. The Kansas City company now has about 125,000 subscribers in connection with its various exchanges.

The sale of the Kansas City Telephone Company includes the Home Telephone Company, of Joplin, Mo., and the Kansas Telephone Company, of Lawrence, Kan. Gary interests retain control and ownership of the Kansas City Long Distance Telephone Company. They also will continue to operate their telephone properties in Texas, Illinois, Missouri, and Iowa, and their large manufacturing plants for automatic equipment both in this country and abroad.

Omaha, Neb. — Frank Bracelin, Minnesota division manager for the Northwestern Bell has been named chief of the commercial department of that company following the promotion of Lloyd B. Wilson to the Bell headquarters staff as commercial engineer.

Invention Affects Plant

A Preliminary Survey of the Effect of Modern Inventions on the Economics of Telephone Plant Design — Automatic Switching and Vacuum Tube Development Two Important Factors

By F. J. DOMMERQUE, Fellow, A. I. E. E.

Telephony is passing just now through a transition period. The first quarter of this century has sufficiently demonstrated that automatic telephone service will be dominating the future development in the art. Of course there are limits to this development. A machine can be made to write, but it cannot be made to think; therefore, whenever conversations calling for brain action are to be handled, as for instance in toll and long distance work, manual operation is yet to prevail for a long time to come. As a general rule it may be said that the greater the number of telephone calls requiring the same uniform method of service the more appropriate and economical automatic operation becomes.

As desirable, however, it may seem to introduce automatic service generally, there are many obstacles still to be overcome, principally of a financial nature. The majority of manual switchboards has not yet reached the end of their useful life, consequently there have not been accumulated sufficient depreciation funds for replacement by an automatic equipment. If in a manual multi-office system one or more offices have reached the replacement point, the money set aside for such replacement can be used for automatic equipment and in that manner a complete automatic system can be built up gradually.

Change to Automatic Affects General Plant Design

It is an economical feature of an automatic installation, at least of those operated with switches of the step-by-step motion type, that the most economical number of offices is greater than if the same installation were operated manually. As a consequence the wire plant is considerably affected by a transformation from manual into automatic operation, a circumstance which must be taken in consideration right from the start. Another factor in the change to automatic operation is the question of personnel. The operators become superfluous and have to be discharged or otherwise employed. The operation and maintenance of automatic switching paraphernalia demand a higher degree of mechanical and electrical skill than is found as a rule in the average run of telephone exchange employes. It takes considerable time to educate an organization up to the standard required for reliable operation of an automatic exchange but it would not go without it.

In small communities needing only one or a few operators for the local service the purchase of an automatic equipment would exceed the cost of a new magneto board, besides the change to common battery and a probable interference with the rural line service would have to be taken in consideration. But if a number of communities were so located that they could be connected to a common center such as is often selected as switching point for long distance service, then for local service the same district could be organized as an automatic unit by placing the selectors at the district center and the line and connector switches at the individual communities, the long distance calls being handled by operators who could also attend to the rural lines in the district. Such a scheme would work out to advantage by the use of the latest devices such as companion and time-zone switches invented for just such purpose as this. These devices and their application were recorded in TELEPHONE ENGINEER, some months ago.

There is another factor making in favor of automatic switches replacing the manual switchboards. All indications point to it that automatic apparatus will be made cheaper and more compact in the not distant future, which will affect in the first instance the large exchanges where space is of greater value than in small exchanges; but it also will give a new impetus to the development of automatic operation in small exchanges. Furthermore a substantial decrease in cost of automatic apparatus will have an effect on party-line service. It cannot be denied that, if a subscriber could enjoy single line service for the same price as he pays now for party line service or for a small amount more, he would prefer the single line. As in multi-office exchanges (and all automatic installations of any appreciable size will be multi-office exchanges with sub-offices or branch offices, or both) the increase in the number of offices when the automatic service is introduced, would mean shorter subscriber's lines and as in any case four-party lines are never filled, one must come to the conclusion that there would not remain sufficient inducement for their retention, all the more as the wire plant is being cheapened by the universal use of small gage cables.

Vacuum Tube Applications Modifies Long Distance Lines

A more recent revolution in the art of telephony has been brought about by the invention of the vacuum tube. This revolution, it is true, has not affected the exchange equipment or its operation, but it has influenced immensely long distance service and line construction in general. Communication can be carried on over distances believed insurmountable only a few years ago. This is due to the vacuum tube's service as a repeater. But that is not all. The vacuum tube has made possible the use of very small wire gage; thus it is possible to obtain good transmission over a 22-gage cable where without amplification probably a 16-gage cable would be required, whence the possibility of using cables between many long distance points with sufficient traffic instead of open wire as heretofore. It can easily be seen how this will revolutionize the entire toll and long distance plant. The desirability of procuring uninterrupted service on the costly long distance lines will invite the operating companies to replace their open wires by cables whenever the traffic warrants it; the limit of this expansion is not in sight by far. The vacuum tube has taken the loading coil out of the open wire long distance lines because of the difficulties experienced in balancing the line, and as far as multiplex telephony is concerned it is not at all certain that it may turn out greater economy to use individual cable circuits for each communication instead of a single open wire metallic circuit for four or five simultaneous conversations.

Radio to Extend Range, Not Character, of Communication

Great progress has been made in wireless or radio telephony. However, this field of exploitation seems to be very limited as far as commercial telephony is concerned. It may be of considerable value to ocean traffic and to reach isolated points or islands where a submarine cable is out of the question, but otherwise radio transmission of speech or music will probably remain confined to broadcasting and amateur work. The laying of the

Havana-Key West cables as late as 1921, at a time when radio telephony and its possibilities had been successfully demonstrated, indicates that a submarine cable must present economies over radio transmission in certain cases, as surely in a case where as much capital was involved, the highest talent has been employed to find the most practicable and economical solution of the problem.

The Havana-Key West cables demonstrate also the economy of allying telephony and telegraphy whenever possible. Every telephone man is familiar with composite circuits; carrier currents have become known by their application in radio telephony and telegraphy; the telephone and the telegraph meet everywhere on common ground and the old-time frontier between the two sciences is being obliterated more every day; nowadays it is electrical communication. The economy resulting from joint telegraph and telephone administration with joint engineering and construction taking advantage of every opportunity to utilize the same appurtenances, in their entity or only partially, has been taken advantage of in nearly all European countries.

It is astonishing to what extent the telephone has invaded the railroad service; there is no doubt that the telephone has done more for the good of railroad dispatching, signaling and traffic in general than the telegraph ever could. In railroading it shows to perfection what can be accomplished when the two arts join hands.

How Can Advantage Be Taken of This Progress

With these preliminaries the question now arises, how can the entire structure of telephonic operation be arranged to derive the greatest benefit from the progress made in the art; simply by constructing and operating the telephone plants so as to obtain the lowest annual expense compatible with a service conforming to a prescribed degree of efficiency. What constitutes this degree of efficiency? First, a transmission of speech which satisfies the subscriber; second, an assurance of obtaining the desired connection, and third, prompt service.

The transmission depends on the quality of exchange equipment and of the lines. At the present stage no fear needs to be had for the efficiency of the exchange apparatus as the production of the switching paraphernalia, manual as well as automatic, has attained such a degree of perfection that they are absolutely reliable in construction and operation. For the circuit it may be said that they are designed with respect to transmission efficiency so as to contain a minimum of contacts and resistance, and what there is left in the talking circuit will not injure transmission. The whole weight of speech transmission, therefore, rests substantially upon the wire plant.

As far as the second requirement, certainty of obtaining connection, is concerned, experience has educated the manufacturer to build reliable apparatus and the employes of the telephone companies to operate it skillfully. Line construction and line maintenance has been practiced for so many years, that no danger is to be feared from that quarter. But there is an economical limit to the quantity of apparatus to be installed. If it would be demanded to provide facilities for absolutely perfect service without failure to obtain connection under all circumstances a great part of the plant would lay idle most of the time, and the expense caused thereby would be too burdensome and unwarranted. Hence a degree of certainty must be fixed, which still assures satisfaction on the part of the subscriber. This degree is expressed by the probability 1:1000, which means that the facilities for making connections are such that in all probability out of every 1000 calls made one only will fail. Of course calls for busy lines are not included in the 1000. The probability is meant for such connections as can not be completed on account of lack of sufficient means for connecting. Such means include manual service or switches in automatic service, trunklines in either service. The engineers are responsible for the proper determination of facilities to be provided so as to give the probability 1:1000 a practical meaning.

Prompt service implies that the subscriber is not kept waiting too long for a connection. In manual service the operator is first of all expected to answer a call quickly. Two-second service is considered good service; if the operator asks the calling subscriber for the desired number inside of three seconds after the call was originated, the service may still be acceptable, but waiting longer for an answer means poor service. If the calling party heard the operator's voice in an appreciably short interval of time after he removed the receiver from the hook, he will be contented; if he should have to wait quite a while for the completion of the connection, he will not easily grumble as he will attribute any delay to the tardiness of the called subscriber as long as the operator answered him promptly.

Where connections are made automatically the situation is more favorable. The subscriber in that case does his own operating and as he is occupied and solely responsible for his actions he will not loose patience; if the switches move fast enough so as to arrive upon the proper contacts before the subscriber rotates the dial again to set another digit, all goes well. The principal requirement is that the time sequences of switches and relays are correctly determined and followed out. M. McCulloh, president of the New York Telephone Co., says: "Machine switching is here to stay. By actual checks we have found that it is 20 per cent faster than manual switching."

It will be noticed that the efficiency qualifications just explained pertain to local service; for toll and long distance service reliability and promptness of connections are just as desirable, but to set a fixed limit is rather difficult as the circumstances under which the connections are made vary with kind of call and with distance. The entire long distance service is a proposition by itself and is the same whether the local service is manual or automatic.

Least Annual Expense the Index of Best Arrangement

It be now assumed that the required degree of service efficiency prevails through the entire telephone plant and forms the basis upon which the discussion of the annual expenses takes place.

The annual expenses are composed of the cost of operation, the cost of maintenance, and of interest and depreciation.

Before entering into the study of the ways and means whereby a minimum of the annual expenses can be obtained it will be well to examine the circumstances under which the study is to be made.

As indicated in the beginning the telephone business is at present in a state of transition. Consequently it may be taken for granted that no large scale installation of common battery manual boards are to be expected while there exists still the possibility of renewing magnetic boards, as the occasions of joining magneto exchanges into a district for automatic operation do not offer themselves everywhere. In such cases where a community is isolated the proceedings are simple, as no choice is left. A new magneto board will then be justified or possibly even a common battery board.

If, however, the location of the community requires a renewal of a magneto board such as to present a possibility of joining a district development in the near future a magneto board, which still possesses some usefulness but has been discarded by a community which saw an advantage in joining a district formation, may be installed temporarily.

A development study for small exchanges is only then profitable when a district formation is contemplated. A development study for common battery exchanges which are to be operated manually for some time to come should, however, include their transformation to automatic service. In fact the study should be made on the basis of complete automatic operation of the plant, but with due consideration to the existing plant as not only the office buildings but also a

considerable part of the wire plant can be utilized to good advantage in the new development.

The term "automatic" has here been used advisedly, so as not to differentiate between systems. There are two entirely different automatic telephone systems in use (leaving out of consideration the so-called Relay System, which has not been in use long enough to be considered as established), namely the step-by-step motion system, of which the original Strowger System is the best representative, and the power-drive switching system. In reality all step-by-step motion systems are only modifications of the Strowger idea which uses the 100-line switch consisting of 10 levels of 10 lines each, the contact brushes being first lifted to the proper level and then rotated to the proper contact in that level, or vice versa.

The power-drive switching system is exploited principally by the Western Electric Co. and employs 200-line rotary and 500-line paneltype switches. Rotary switches are used in Europe and paneltype switches in America. 200-line and 500-line switches have been chosen to obtain large trunk groups, which are more economical than small trunk groups. The very large exchanges derive the greatest benefit from these types of switches.

The step-by-step motion switches appear, however, to possess more flexibility and certainly are better adapted for small exchanges where the trunk groups of 10 are not at a disadvantage. Moreover, there does not seem to exist any difficulty to obtain the same results from a step-by-step motion switch as from the power-driven switch by grading and slipping the multiple and introducing distributor switches. Thus it appears that the step-by-step system is more flexible and consequently possesses a more universal character. Moreover, as it is the oldest and most widely known system, it may, therefore, be taken at the present stage of the art as the representative automatic system and as best adapted for studying telephone problems involving automatic operation.

B. G. Hubbell, Pioneer, Passes

Noted Independent Veteran Dies at Buffalo—Was Factor in Radio's Rise

Buffalo, N. Y.—Following a brief illness, Burt Gage Hubbell, pioneer organizer of Independent telephone systems and an outstanding figure in the radio industry, passed to his reward Saturday, January 24, at his home in Buffalo, N. Y. At the time of his death, Mr. Hubbell was president of the Federal Telephone & Telegraph Co. and of the Federal Telephone Manufacturing Corp.; also, of its subsidiary companies in Illinois, Massachusetts and California; the General Drop Forge Co. in Buffalo, and the Century Telephone Construction Co. of Canada.

Mr. Hubbell was born in Cleveland, July 6, 1865. Following his graduation from the public schools in that city, he joined his father, Henry S. Hubbell, in the wholesale lumber business, later establishing his own business at McKeesport, Pa. In 1890, he married Jessie Beach, daughter of G. M. Beach, general manager of the Big Four railroad, Mrs. Hubbell dying in 1915.

While in McKeesport, Mr. Hubbell organized the McKeesport Telephone Co. and in 1900 organized the Century Telephone Construction Co. In 1901, the Consolidated Telephone Co. was added by Mr. Hubbell as a holding company and the Inter-Ocean Telephone & Telegraph Co. as a long distance company, subsidiary to the Consolidated.

In 1905, the Consolidated Telephone Co. purchased the Frontier Telephone Co., the local Independent telephone company of Buffalo. In 1909, the Federal Telephone & Telegraph Co. was incorporated with Mr. Hubbell as president and later, the Frontier Telephone Co. and others were merged into the Federal organization. In 1918 Mr. Hubbell disposed of the operating property of the Federal Telephone & Telegraph Co. in New York state, consisting of the local Independent telephone exchange in Buffalo and some 72 Independent exchanges in Western New York to the New York Telephone Co., retaining the Century Telephone Construction Co. and the companies operating Independent exchanges in Sayre, Athens and Shinglehouse, Pa.

Mr. Hubbell, long interested in the development of radio communication, then entered into the manufacture of radio receivers and other types of radio apparatus, and the wealth of constructive knowledge that he brought into the new industry was of import in its general advancement.

Mr. Hubbell is survived by a daughter, Mrs. Leonard R. Bissell, and a sister, Mrs. Byron L. Moore, both of Buffalo. He was a member of the Buffalo, Athletic and Country clubs of Buffalo; Westchester-Biltmore country club of Rye, N. Y.; Union League, Railroad and Lotus clubs of New York City; Niagara club of Niagara Falls, N. Y., and the Ohio society.

Funeral services were conducted January 26, in Westminster Presbyterian church, Buffalo, with interment the following day in Lakeview cemetery, Cleveland.

Indiana Commission Approves "Reasonable" Ad Cost

Marion, Ind.—"Reasonable advertising expenses connected with utility operation are proper charges to operating expenses of the company," states the Indiana Public Service Commission in a letter to the editor of the Marion Chronicle. The commission denies that it ever gave the view that such expenses were illegal or unlawful charges.

The letter was in response to a letter received by the commission from Lindsay, inquiring concerning the attitude of the commission in regard to newspaper advertising by public utility companies. In his letter, Lindsay says: "I have been told that the position of your commission on the matter of utility advertising has caused the cancellation of advertising projected by the Indiana Bell Telephone Company in sixty-four Indiana papers."

The commission sets forth its position in its letter of reply in the following words: "It is the position of the commission that reasonable advertising expenses, connected with utility operation, are proper charges to operating expenses and that, when there is a reasonable doubt as to whether such a charge is proper, the doubt should be resolved in its favor. This position should not cause the cancellation of any projected legitimate advertising by any utility."

The letter further says:

"In sixteen months the commission has mentioned the item of advertising in one single case."

The statement referred to by the commission was made in the recent order granting the Indianapolis Water Company increased rates based on a federal court injunction establishing a value of $19,000,000 for the company. The company books showed that the company had charged in addition to advertising such expenses as personal club dues of its officers, cigars and other items as operating expenses of the utility.

One out of every 1,600 motor cars in the United States at the present time is the property of the Bell Telephone system. The Bell has more than 9,000 motor vehicles.

Radio Raises Fredonia Income

Kansas Town of 4,000 Is Successful Pioneer in Furnishing Subscribers With Pick of Broadcast Programs—Some Users Not Phone Subscribers

By GILLIAMS SERVICE

Fredonia, Kan.—Fredonia's enterprising telephone company is now giving its patrons a new service. Those who wish may listen in on the best broadcasting programs by simply calling the phone operator and asking to be connected. Or, if they do not like the idea of listening in with the telephone receiver, loud speaker service will be installed in their homes just as regular telephone lines are put in. The connecting lines run through the regular telephone cables, but do not interfere in any way with phone service. So popular has the idea become that many families have installed loud speaker service in their homes where they have no telephone connection.

To take up your telephone receiver and listen in to the best radio broadcast programs without the trouble of tuning in is a comparatively new sensation, but one which new developments have made practical. One may now simply call the central office and ask to be connected, then settle back and listen contentedly with the telephone receiver instead of the customary radio earphones.

But if the family as a whole wishes to hear radio music and possibly to dance to the strains of a popular jazz orchestra sent over the air, loud speaker service is also available. An ordinary radio loud speaker can be installed in the home, connected by special wires to the regular telephone lines. All the subscriber to this new public service has to do is to turn on a switch. The radio set is in the office of the telephone company.

The co-ordination of the telephone exchange with the radio broadcasting station to spread this form of wireless entertainment more widely than ever has been effected by J. A. Gustafson, manager of the Fredonia Telephone Company, which operates an Independent exchange at Fredonia, Kans. While this Kansas town of 4,000 persons has been the first in the United States to inaugurate such a service for its customers, several other towns are now following suit, and the innovation promises soon to become widespread.

What the ultimate effect of this development will be is difficult to predict. It is hardly likely that the elimination of the individual radio set is to come as a result. There remains too much pleasure for the average "fan" in doing his own tuning in, selecting the particular station he wishes to hear, and trying for long distance reception, for any such form of standardized radio receiving to become universal. However, if the widely discussed plans for a few super-broadcasting stations to take the place of the hundreds of smaller stations should ever come to pass, the opening for such a system would, of course, be apparent. Selective radio sets would be thrown into the discard, the radio service supplied by the great telephone companies would become a generally used public service. In fact, this would ultimately eliminate the "wireless" part of wireless telephony, for the telephone company could easily send its programs over land wires without bothering with the ether waves. Few radio "fans" hope for such a day, however.

Meanwhile, the novel service supplied to citizens of the southeastern section of the Sunflower state fills in a need that does exist. There are, undoubtedly, thousands of people who either cannot afford the expense of a good commercial set and have not the time to build their own, or who will not take the trouble to tune in various stations and tune out static and other disturbances. For these people the service of the Fredonia Telephone Company comes as a real public utility.

If a loud speaker is installed in their homes, a monthly rental is paid to the company as a separate line is necessary for this convenience. The company connects the loud speaker in the home to its amplifier, the lines running through the regular telephone cables. Thus radio programs are supplied without the trouble of tuning in.

A microphone is placed in a different church each Sunday to give subscribers the local church services. Sometimes the company puts on its own broadcast programs. Forty loud speakers are operated in a town eleven miles from the central receiving set.

Both of the political conventions were heard by these subscribers through the medium of the radio set in the telephone exchange. The acceptance speeches of President Coolidge and Mr. Davis were received most satisfactorily, and more people in Fredonia, according to the size of the town, heard the political conventions and the acceptance speeches than in any other town in the United States. Radio reports of the world series ball games and of the actual election returns were heard by these radio-telephone subscribers.

A loud speaker is installed in the same manner as the telephone except that a small switch is connected in so that the listener can cut out the horn at any time.

A number of power amplifiers are used in supplying this service. The power from each amplifier is divided by a one-to-one repeating coil as it goes out on the lines. With five to six cable pairs on each coil, this helps to overcome the ca-

Upper left—Fredonia's radio central station equipment—Miss Ruth Fuegham is operator in charge. Upper right—J. A. Gustafson, manager of the Fredonia company, is holding one of the loud speakers installed for the wire-radio service. Lower left—Sporting event, election and other news radio-wire service draws crowds to store subscribers. Lower right—Governor and Mrs. Ben Paulen of Kansas are among the radio-wire subscribers when they're in their own home.

pacity of the cable. Each amplifier operates from 60 to 75 horns.

This service in no way interferes with the telephone service. While connections on the switchboard have been made so that any subscriber can call in and have the operator connect him with radio on his regular telephone, the number that can listen in this manner is limited to the number of cords the operator can spare.

"Using this system of ours," says Gustafson, "it would be possible to connect every town in the United States possessing a telephone exchange. Think of how the people could be reached by fine lectures and other educational material. Keep on thinking and you will see new possibilities."

Many are those who have found this service of great value. A busy store, for example, that wishes to interest its customers and increase its trade by furnishing radio programs finds this an invaluable facility. Those in charge of the store would, naturally, be too busy to tune in the desired programs, but by this loud speaker service a switch is turned on, and the broadcasting fills the store or is transmitted to crowds in the streets.

Often, at a public dance or a large dinner, it is wished to have reports of an important sporting match or an election given to those present, and a radio set is hired for the night. But those in charge are frequently unfamiliar with its operation, and, in any case, the installation and tuning in requires considerable trouble. The telephone company can, on the other hand, quickly install a loud speaker, connected to its telephone cables, and the desired program is given to the guests present by simply turning on the switch.

Governor and Mrs. Ben Paulen, of Kansas, are among the most enthusiastic of those who endorse this service. The governor and his wife listened to the election returns this fall as they came through the loud speaker furnished by the telephone company. The returns came in perfectly, as they did to the hundreds of others who were supplied with the service, and the governor pronounced himself as thoroughly satisfied with the new idea.

Miss Ruth Fuegham is the radio-telephone operator for the new system, and the entertainment of the subscribers is dependent upon her tuning in. So far she has never failed to give the best presentation possible of any program, eliminating static to a greater extent, say the users of the service, than they have been able to do themselves on their individual sets.

Gustafson himself is in doubt as to just what the future of his development will be. Although he sees its ultimate possibilities, he does not claim that it will bring any such revolutionizing changes in radio.

Bell Lab. Details Its Plan

Announce Personnel of Bell Telephone Laboratories, Inc. — Building Larger Laboratories

New York City—Extensions of laboratory facilities for the scientists and engineers of the new Bell Telephone Laboratories, Inc., are already under way. Laboratory space in the form of a new building covering almost a quarter of a city block will be added to the 400,000 square feet at present in service in the group of buildings at 463 West street, New York City. At the date of incorporation, the personnel numbered approximately 3,600, of whom about 2,000 are members of the technical staff, made up of engineers, physicists, chemists, metallurgists and experts in various fields of technical endeavor.

The chairman of the board of directors of the Bell Telephone Laboratories, Inc., is General J. J. Carty, vice-president of the American Telephone and Telegraph Company. Other members are: Dr. F. B. Jewett, formerly vice-president of the Western Electric Company, president of the new corporation, and also recently elected vice-president of the American Telephone and Telegraph Company; W. S. Gifford, executive vice-president of the American Telephone and Telegraph Company; Bancroft Gherardi, vice-president of the same company; C. G. Dubois, president, and J. L. Kilpatrick, vice-president of the Western Electric Company, and J. B. Odell, assistant to the president of the Western Electric Company.

The operations of the Bell Telephone Laboratories, Incorporated, are under the direction of E. B. Craft, executive vice-president, who was formerly chief engineer of the Western Electric Company.

In the functional division of the research, development and engineering work of the laboratories, physical and chemical research is organized under Dr. H. D. Arnold, director of research; development of apparatus under J. J. Lyng, apparatus development engineer and development of communication systems under A. F. Dixon, systems development engineer, all formerly concerned with similar activities in the engineering department of the Western Electric Company. Dr. R. L. Jones, inspection manager, continues his former responsibilities in engineering inspection, and S. P. Grace, commercial development engineer, those of commercial development.

The patent work of the Laboratories is organized under J. G. Roberts, General Patent Attorney, formerly Assistant General Patent Attorney of the Western Electric Company.

The corporate and commercial relations of the laboratories are under the direction of Vice President E. P. Clifford, who was formerly Commercial Manager of the Engineering Department of the Western Electric Company. John Mills continues as personnel director, responsible for personnel activities, and educational and college relations.

The formation of Bell Telephone Laboratories, Incorporated, provides an individual organization, the whole activities of which may be more efficiently devoted to the furtherance of research, development and engineering investigations along the line in which the parent companies have already made such remarkable progress. Its formation is an indication of the estimate which these companies place upon the importance of properly organized research and is a promise of continuous service to the public, to the communication art and to the progress of science.

W. S. Gifford President of Bell—H. B. Thayer Board Chief

New York City.—H. B. Thayer's occupancy of the newly created position of chairman of the board of the American Telephone and Telegraph Company, brought about the election of Walter S. Gifford to the presidency of the Bell System, and makes him, at 40, one of the youngest heads of a major American corporation.

Mr. Gifford's first employment following graduation from Harvard was with the Western Electric Company. After serving with the Western Electric for some years he was appointed chief statistician by the Bell. In 1916 he entered war service as director of the Council of National Defense and as supervising director of the committee on industrial preparedness of the Naval Consulting Board.

At the close of the war Mr. Gifford returned to the Bell as comptroller and a year later was made vice-president in charge of finance and accounting. In 1923 he was made executive vice-president.

Operator Heroine Burns to Death at Post

Brooks, Me.—Mrs. Carrie Johnson, a crippled telephone operator burned to death January 9 when she remained at her post, summoning outside aid for a fire which destroyed six buildings, including that which housed the telephone exchange.

Planning Cable Plants

Some Suggestions of Practical Methods That Assure Freedom from Ordinary Growing Pains—Making the House Count—Wire Distribution Center—Buried Cable

By P. KERR HIGGINS

The providing of telephone facilities for any community calls for the greatest possible care, not only to provide for present requirements, but to see that future growth can be taken care of at minimum cost to the company and at the least annoyance to patrons. A detailed study of the territory, town or city is necessary in order that all conditions may be given proper consideration. The present telephone possibilities should be determined carefully and an estimate made of the growth possible within the next five, ten and fifteen years. If the plant is already in existence, this "development study" should be made so that extensions and additions will fit into the old plant economically. It may be remarked that it is not always necessary to make extensive additions to a plant which is congested as frequently a few cable cuts will provide relief at minimum cost.

Regardless of how much money is expected to be spent in building, rebuilding or making additions, the work actually done should fit in with ultimate plan as developed by the study. The desirability of having a complete plan under which to construct or reconstruct a telephone plant has never been questioned and in almost if not every case it has been demonstrated that the economy of placing cable depends very largely upon the growth to be expected.

For aerial construction, it appears to be economical to plan the main aerial cables on a basis of not less than five years' growth and the distributing cables (fifty pairs or less) for ten or fifteen years' growth. Aerial construction is generally to be preferred where conditions will permit it and there is a clear right of way. When more than four hundred pairs are required, the difference in cost between aerial and underground construction is comparatively small. In such cases, in deciding between aerial and underground cable, serious consideration should be given to the possibility of interruption to service as well as other not strictly economic considerations. These favor underground construction and it would appear that underground construction should always be preferred except where the costs for any reason are abnormally high. When existing lines can be utilized, it is economy to retain the aerial construction up to the physical capacity of the pole leads.

For cities and towns which are provided with alleys, it is cheaper and as a general rule better to run the aerial cable leads in the alleys than on the streets. It is to be noted, however, that as the ratio of the length to the width increases, the relative advantages of alley distribution become less. Where alley distribution is not feasible or practical, a cable lead on every second street is the next best choice, unless the development is very light.

When underground work is planned or required, the greatest possible care is necessary to provide for the ultimate requirements and in the case of buried cable an effort should be made to estimate the requirements for not less than twenty years. In the case of conduit work from fifteen to twenty years is also necessary. In conduit work it is good practice not to install less than two ducts even on laterals. This can be done at small cost, as the excavating and filling takes up the greater part of the cost of conduit work.

Making the House Count

As indicated previously, before any work is begun a "house count" should be made, carefully classifying each house as to what kind of service if any they can afford. Considerable judgment and experience is necessary to do this work properly. The average residence, likely to take telephone service, is assumed under normal conditions to be able to afford five per cent of the rental value of the property. At the present high rentals, probably three per cent will be more correct. If the rental value is not known, then it must be estimated to determine the class of service which might be used. The "house count" should show every house accounted for and should have separate markings to indicate present and prospective subscribers, using a code for this purpose. The information obtained from the house count information is reduced to terms of cable pairs and is placed upon a map called the block study and from this the wire distribution center or theoretical exchange location is obtained.

There are two distinct classes of engineering in telephone work, namely, commercial engineering and plant engineering. The former looks at the commercial problems presented to them from the dollar standpoint, while the latter looks to the problem from the ideal distribution point of view. Where possible it is considered good practice when making the house count and block study to have a representative of each of these departments so that any questions which may arise may be decided on the ground or immediately referred to the proper person for decision.

It is the general engineering practice to provide one cable pair for each direct line, eight-tenths of a pair for each two-party subscriber and four-tenths of a pair for a four-party station. The number of lines required can be obtained by multiplying the number of stations by these factors. The required number of lines for each block should be entered in large figures inside of a circle placed on the block to which the figures apply.

The best map for developing study purposes is one having a scale of 400 feet to the inch. A Van Dyke should be taken from the original tracing and all the unnecessary lettering painted out with opaque. Prints from this Van Dyke will show blue lines on a white print. The first thing to be placed on this print should be the number of lines needed in each block, assuming that all business telephones are direct lines. Prospective private branch exchanges should have allowance made for not only trunks, but battery and generator service.

Summarizing what has just been said, the block study map should show (1) the number of present telephones; (2) the number of present lines; (3) the number of telephones and lines in prospect by the end of the period for which the study is made. It is later used to determine (1) the ratio of present telephones to population; (2) the center of wire distribution; (3) the pole distribution; (4) the cable routes; (5) the preliminary cable layout.

Determination of Future Requirements

The study is now begun to determine the requirements of the fifteen or

twenty-year period. This is done by dividing the number of present lines by the present population, thereby obtaining a percentage factor which is reasonably constant as the population increases. That is to say, if the estimated population at the end of fifteen years is determined, this figure multiplied by the percentage factor will give total lines needed for the fifteen-year period. To estimate the population for any future period (say fifteen years) it is necessary to plot a curve showing the population of each year for as many periods as you can obtain. Such a curve is shown in Fig. 1. By extending this curve from the present to the five, ten and fifteen-year period, the estimated population at that time can be reasonably estimated. These figures, however, should be checked up with any local data or information which might throw light on the growth of the population, such as location of new factories, etc. Too much dependence should not be placed upon information obtained from local officials as these officials are frequently inclined to be entirely too optimistic as to the future.

Even in the small cities it is now necessary to take into consideration the possibility of what was formerly a large private home being converted into an apartment house, or new apartments erected. The ratio between business and residence telephones once having been determined is likely to be reasonably constant with the city's growth. The extent of the business area must also be carefully estimated. If scattered, this area is inclined to fill in rather than extend. The present tendency of the business section of the modern city, even small ones, is to grow upward rather than go further out. It is therefore wise in planning the business demands to assume that the existing business area is fully taken up, a telephone being in every place where there could or should be one whether it is there at present or not. The remaining lines are then distributed over the estimated additional business district. The direction in which the city is liable to improve is also an important factor. When the block study has been completed, it should show not only present but future requirements.

Wire Distribution Center

All of the previous work has tended to assist us in determining the wire distribution center or the proper central office location from an economical standpoint. It is noted, however, that we have two sets of figures, namely, present and ultimate. Hence, there will be naturally a present center of distribution and a future center of distribution. These centers of distribution are obtained by placing a ruler or straight edge on the edge of the map parallel with the principal street toward the center of the map. We then start from the edge and count all present lines as indicated until we reach a number equal to one-half of the total present lines. Then draw a heavy pencil line along the straight edge across the map, as shown by line XX in Fig. 2. This will divide the map into halves with about an equal number of present subscribers in each section. The straight edge is now laid on the map at right angles to its first position and the counting repeated until one-half of the total present lines have again been counted. By drawing a heavy pencil line (YY in Fig. 2) so that it will bi-sect the first line, the present center of distribution is shown at the point of intersection of the two lines. It is noted that this method divides the map into four nearly equal parts. By repeating the process and counting the ultimate lines, the ultimate center of wire distribution can be secured. Both of these centers are theoretical but necessary in order to give us an "ideal center."

In determining the logical center of distribution from the two above factors, present and future, one must be governed by the possibility of securing proper and suitable quarters at a reasonable price. We must also consider the character of street paving and the cost of real estate. The two theoretical centers above mentioned are likely to be some distance apart, hence the ideal center would be at some point approximately midway between them.

Planning the "Skeleton Feed"

The next step in the study is to prepare a pole, and if necessary a conduit layout, sometimes called a "skeleton feed," merely indicating the route the lines will take from the central office to the substation. Before deciding upon definite routes, an inspection of the territory is necessary, and going over private property should be avoided in every case where possible to do so. Where such is absolutely necessary a suitable right of way should be obtained. The cable routes usually follow the "skeleton feed" unless local conditions prevent this being done. Examples of the skeleton feed are shown in Figs. 3 and 4. Only in very rare cases should cables less than twenty-five pair be used or terminals less than fifteen pair.

In laying out cable routes, it is customary to begin at a point farthest from the office. When a point has been reached where the total immediate requirements equal approximately 160 pairs, that is, the total of the sub or branch cables, then a main cable of not less than 200 pairs should be installed. Cable requirements are usually figured on an 80 per cent basis. The size of cables having been determined and the distributing cables centralized at the connecting point with the main cables, the next step is to

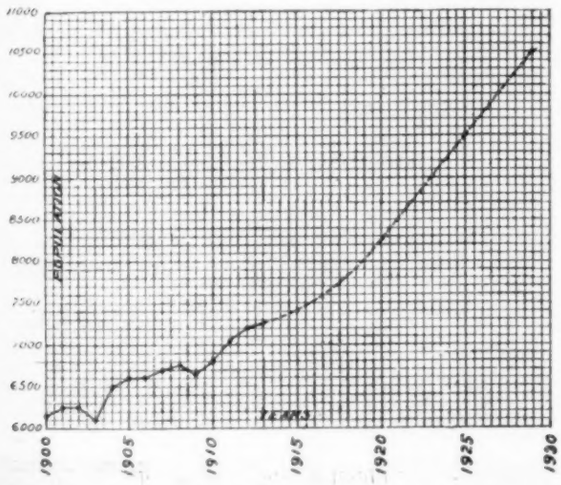


Fig. 1—An estimate of population curve.

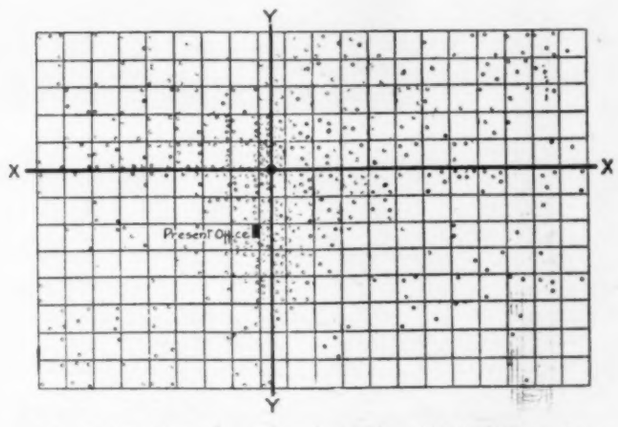


Fig. 2—Finding the theoretical wire distribution center.

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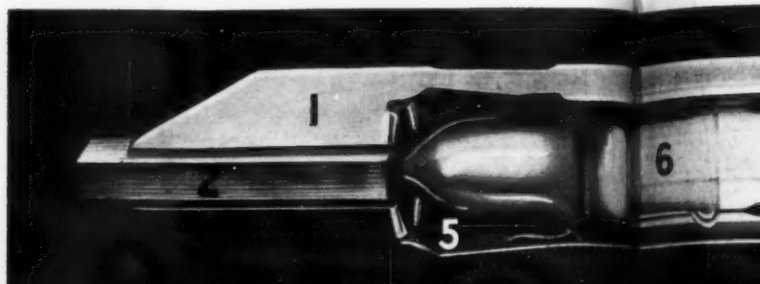
with Kellogg Lif

Study the Construction of this Switchboard Lamp



1. Punched brass contact plates.
2. Heavy insulator and mounting
3. Tipless globe, improved shape.

4. Filame
5. All ins
6. Inner

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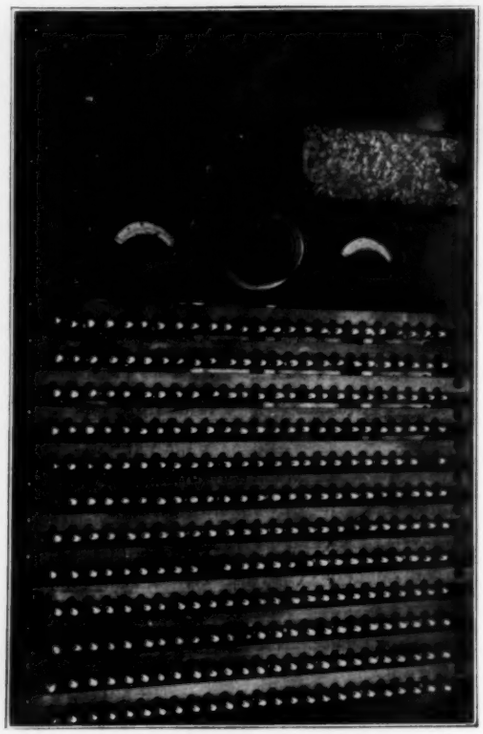
Correct leng to give p



The Lamp Test Board

Stock Lamps Picked at Random from the Test Board

Date Started	No. of Hours Burning—Dec. 1	
4-29-20	(4 yr.-7 mo.-14-da.)	39,936 hours
12-1-23	(1 yr.-12 da.)	8,928 "
3-11-24	(9 mo.-1 da.)	6,504 "
8-25-24	(3 mo.-18 da.)	2,592 "
6-9-24	(6 mo.-3 da.)	4,392 "
10-25-19	(5 yr.-1 mo.-18 da.)	44,352 "
2-20-20	(4 yr.-9 mo.-23 da.)	41,592 "
1-25-23	(1 yr.-10 mo.-18 da.)	16,272 "
11-23-21	(3 yr.-19 da.)	26,376 "
4-23-20	(4 yr.-7 mo.-20 da.)	40,080 "
5-10-20	(4 yr.-7 mo.-2 da.)	39,648 "
2-23-20	(4 yr.-9 mo.-20 da.)	41,520 "
6-3-20	(4 yr.-6 mo.-9 da.)	39,096 "
1-14-21	(3 yr.-10 mo.-28 da.)	33,792 "
11-30-23	(1 yr.-2-da.)	8,688 "

Check your lamp cost with this record.

CONTIN and co switchboa

The Kellog take great

They are u them consi

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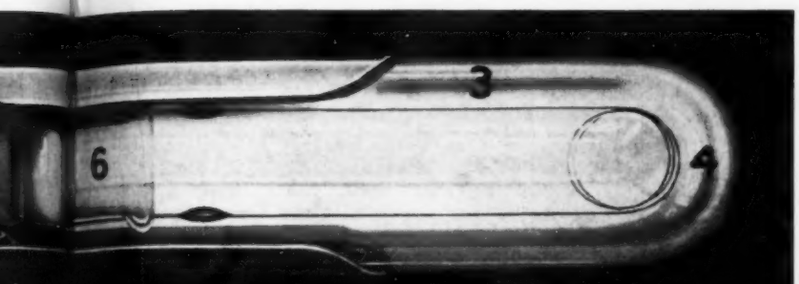
407 Bro E. Burnside

cboard Lamp Cost

ggg Life Lamps



4. Filament equal distance from globe.
5. All inside soldering.
6. Inner glass mounting protects filament.

p to base, cannot catch in the jack.
to give proper light.

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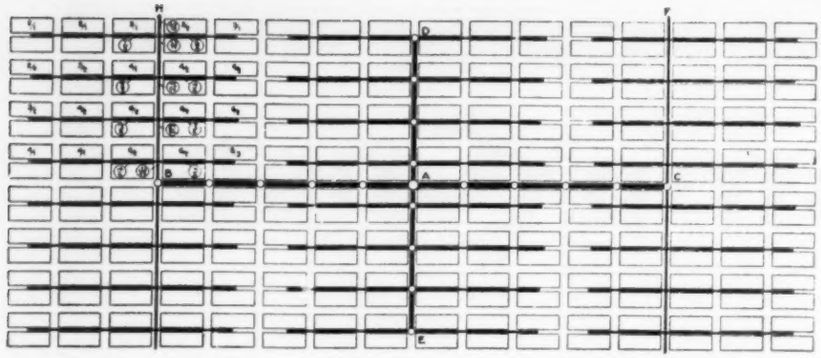


Fig. 3—Typical cable layout for a small city. Heavy lines represent conduit or buried cable; light lines, aerial. Number of ducts in small circles.

assign a letter or number to each main cable.

The conductor numbers are now assigned to each distributing cable, starting at the distant end and bringing out the conductors at the various points or outlets between that point and the central office until all of the conductors of the main cables have been assigned. The general plan is illustrated in Fig. 5. The proper size of the various sections of the cable can then be designated. Before the remaining distributing cables can be assigned conductors, the fill of the smaller sections should be determined and the balance of the distributing cables assigned divisions in the main cable so that all requirements will be cared for.

Relief Points Should Be Provided

The distribution of cables should be so arranged as to provide a point of relief for future additions should they be found necessary. These points should be so marked that additions can be made with a minimum outlay of labor and material and the least possible interference with the service. On Fig. 5 a relief point is indicated by X. Where party lines are used, they should be confined to definite sections of the cable so as to avoid the necessity for using two sets of cable conductors.

Conductors in cables are made available for connection with the substations by means of cable terminals, located at suitable points along the route. These points are determined before locating the terminals by spotting the subscribers' locations and determining the proper place for the terminals in advance. It is considered good practice to locate a cable terminal on each distribution pole where three or more subscribers' stations terminate. Multiple distribution makes it possible for cable pairs to be available at two or more points. Cable terminals should have a capacity at least 40 per cent above present requirements.

The efficiency of a cable plant is determined from the number of cable conductors in use on the distributing frame at the central office. The greater the number of cable pairs in use, the higher the efficiency of the cable plant. To obtain a high efficiency in underground cables, cross-connecting boxes are sometimes provided at connecting

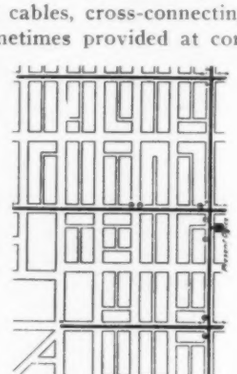


Fig. 4—"Skeleton feed."

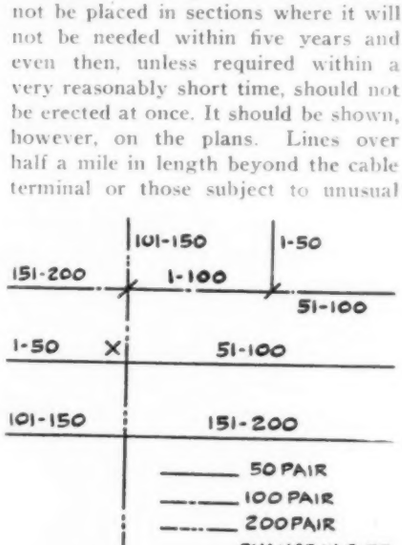
points between underground and the aerial cables. It is also necessary that the cable pairs be brought into a sufficient number of terminals so that at least 80 per cent of the cable pairs can be in actual service before additional cable is necessary. The multipling of the terminals on branch cables depends largely upon the character of the service to be rendered. Party line service calls for a greater amount of multipling than direct lines and well built up districts require less than scattered ones.

All poles should be set after careful investigation so that terminal poles will be stronger than the regular line poles and suitably located. An effort should also be made to locate poles at the intersection of alleys and streets and in so far as possible on property lines.

The present tendency in telephone practice is toward an "all cable" plant. An effort should be made to avoid the use of cross arms on a cable lead wherever possible to do so, except for toll or farmer lines.

The essential principle to be followed in the making of a cable layout is that the lines should be carried as directly as possible to the central office location, yet permitting concentration on main leads to permit the use of larger cables. Experience teaches us that it is economy in an aerial plant to arrange the layout so that several blocks can be served with one lead passing through the alleys. The exception to this is when the ratio of the length of the block to the width is more than two to one. In a city laid out rectangularly with square blocks considerable saving can be had by distributing from leads running through the alleys with the main feeder cables concentrated on a few base lines. Fig. 4 is a good illustration of this plan. It should be noted that "back feed"—that is, cables feeding back toward main base line EAD—are limited to one block in length.

Tables I and II were prepared some years ago by an engineer the identity of whom is unknown to the author. They show the proper poles on which to locate terminals for blocks of different lengths with different numbers of lines in the block, either where the cable goes through the block or where the block is fed by a lateral cable. Fifteen pair terminals are used unless a larger size is required. Cable should not be placed in sections where it will not be needed within five years and even then, unless required within a very reasonably short time, should not be erected at once. It should be shown, however, on the plans. Lines over half a mile in length beyond the cable terminal or those subject to unusual



STATEMENT OF FILL.

Count.	1st Cut Out.	2nd Cut Out	Total
1-50	15	22	37
51-100	18	23	41
101-150	8	31	39
151-200	16	26	42
	57	102	159

Size of main cable, 200 pairs.
Number lines required, 159 pairs.
Per cent efficiency, 79.5.

Fig. 5—A per cent study of cable fill.

Poles on Which Terminals Are to Be Placed Where the Cable Lead Goes Through the Block

Length of block, feet	No. poles per block	Lines per block 5	10	15	20	25	30	35	40	50
-200	2	1	*1, 2							
201-350	3	2	2	*All						
351-500	4	2	1, 3	1, 3	*All					
501-650	5	2, 4	2, 4	2, 4	2, 4	*All				
651-800	6	2, 4	1, 3, 5	1, 3, 5	1, 3, 5	1, 3, 5	*All			
801-950	7	2, 5	2, 4, 6	2, 4, 6	2, 4, 6	2, 4, 6	2, 4, 6	*All		
951-1100	8	3, 6	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7	*All	
1101-1250	9	3, 6	2, 5, 8	2, 4, 6, 8	2, 4, 6, 8	2, 4, 6, 8	2, 4, 6, 8	2, 4, 6, 8	2, 4, 6, 8	*All
1251-1400	10	3, 7	2, 5, 8	2, 4, 7, 9	2, 4, 7, 9	1, 3, 5, 7, 9	1, 3, 5, 7, 9	1, 3, 5, 7, 9	1, 3, 5, 7, 9	1, 3, 5, 7, 9

*In cases where terminals are more frequent than every second pole, show on cable plans one terminal for every 10 lines, as it is probable that the irregularities of distribution will allow one or more of the terminals indicated above to be omitted.

Poles on Which Terminals Are to Be Placed Where Cable Lead Does Not Go Through the Block

Length of block, feet	No. poles per block	Lines per block 5	10	15	20	25	30	35	40	50
200-300	2	1	1	1, 2	1, 2	1, 2				
301-450	3	1	1	1, 2	1, 2	1, 2	All	All	All	
451-600	4	1	2	1, 3	1, 3	1, 2, 3	*All	All	All	
601-750	5	1	2	2, 4	2, 4	*1, 2, 3, 4	1, 2, 3, 4	*All	*All	
751-900	6	2	2	2, 4	2, 4	1, 3, 5	1, 3, 5	*1, 5	*1, 5	1, 5
901-1050	7	2	2, 4	2, 4	2, 4	1, 3, 5	1, 3, 5	2, 4, 6	2, 4, 6	1, 6
1051-1200	8	2	2, 4	2, 4	2, 4, 6	2, 4, 6	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7
1201-1350	9	2	2, 4	2, 4, 6	2, 4, 6	2, 4, 6	1, 3, 5, 7	1, 3, 5, 7	1, 3, 5, 7	2, 4, 6, 8

Note—For less than 4 ultimate lines in a block place the terminal on the main lead at the entrance of the block if a pole can be placed there.

*In cases where terminals are more frequent than every second pole shown on cable plans one terminal for every 10 lines, as it is probable that the irregularities in distribution will allow one or more of the terminals indicated above to be omitted.

When distributing into blocks on both sides from a main lead, place one terminal on the main lead opposite the alley if there are not more than 5 lines in each block.

TABLES I AND II.

exposure should be provided with suitable protection. The terminals which are to be protected should be marked.

The writer has purposely left out a great many details in connection with the development study for the construction of a telephone plant and also many major points applicable only to very large centers, as it was not considered vital in the construction of small plants and it is for small plants that these articles are written.

Views on Buried Cable

In planning the cable plant for small properties, the question of using buried cable in place of aerial construction always arises and some additional discussion to present the experience and opinions of the author of these articles may not be out of place at this time.

With the improvements and refinements in the telephone art came a demand for improved maintenance of the outside plant, compelling not only more careful and prompt maintenance, but a higher grade of construction. The modern equipment requires full metallic circuits with high insulation. In order to meet these requirements, even in the smaller towns, telephone companies were forced more and more to place their cables underground due to the abundance of trees and the refusal of the property owners to permit trimming privileges. The larger companies found it easy to install conduit systems because they could finance the expenses as their rate of return was higher than in the smaller communities. Necessity therefore, as usual, was the mother of invention and the small telephone owner tried to accomplish the same objective as the larger company. Finding it impossible to afford the cost of a conduit system, he took a chance and laid his cable in the ground, at first without any protection whatever, only to find his experiment an expensive one, as is frequently the case in pioneering of any kind. He realized that underground cable was desirable both on account of appearance, the reduction of maintenance expense and the liability of trouble. However, he failed to take into account many things which his experience later developed. Corrosion due to chemicals in the soil and also injury caused by excavations in the street were at first not anticipated. We therefore owe a debt of gratitude to these early pioneers in this work for their willingness to take chances and bear the expense of later repairs in order to determine the feasibility of "buried cable."

The writer does not claim to be a pioneer in this regard, but about fifteen years ago laid some cable without any protection in Texas. This cable was in use for about ten years before being replaced with conduit. He was fortunate in this case in escaping any damage from either of the above causes. About three years ago he again installed buried cable, but this time protected only against damage from excavations by placing a creosoted board on top of the cable. Recently trouble developed in this cable and on being located it was found that corrosion had set in and the cable was very badly pitted and in many cases the lead eaten entirely off for a distance of about 30 feet.

He was not fully convinced at the time this cable was installed that the stories of corrosion which were then in the air were true, but this experience proved and demonstrated to his satisfaction that not only must buried cable be protected against abrasion, but also against corrosion due to chemicals in the soil. In the case above cited several thousand feet of cable was buried and only in this one instance has trouble developed due to corrosion. However, there may be other places which have not as yet developed sufficiently to cause trouble. The expense of making repairs in this case of trouble would probably have paid for proper protection against such corrosion.

In addition to the corrosion due to chemicals in the soil, one must also be careful to protect against corrosion due to electrolysis, which will be discussed in a later article. A very interesting and valuable article on the corrosion of lead sheath appears in Vol. 28, No. 9, September, 1924, of TELEPHONE ENGINEER, and the illustrations shown in Fig. 2 of that article illustrate exactly the conditions which the writer found in the case just cited. This article will bear re-reading by anyone interested in this subject. The authors are F. O. Anderegg and R. V. Achatz and the article presents an abstract of the results of data gathered and experiments made by them at the Purdue University Engineering Experiment Station. For the benefit of those who do not have a

copy of this abstract, or do not have time to read it, the following are the conclusions drawn from an analysis of the data gathered and the experiments made at the station: "1. Commercially pure lead sheath under most conditions is corroded less than antimony-lead, but appreciably more than tin-lead. 2. Corrosion generally increases with the quantity of organic matter in the soil. 3. Lime, limestone, cement or mortar aid in the corrosion of lead and hasten its oxidation. 4. Fragments of limestone, crystals of gypsum, etc., in contact with lead hold moisture at the point of contact and aid or promote corrosion. Iron rust stimulates corrosion of lead. Sodium chloride is corrosive. Cinders are corrosive.* 5. The presence of moisture increases corrosion up to a certain point by forming hydroxide. Beyond this point water protects the lead by slowing up the approach of the oxygen necessary for corrosion. 6. In water solutions, nitric acid is more corrosive than acetic acid. Barium hydroxide is more corrosive than sodium hydroxide. 7. In the presence of soils nitric acid forms yellow crystals of basic lead nitrite. Acetic acid forms lead acetate and tends to produce a pitted surface. 8. Corrosion is inter-crystalline at first followed in pure lead and antimony-lead by attack over the whole surface with occasional pitting. In tin-lead further corrosion is almost wholly inter-crystalline. 9. Tin increases the resistance of lead to corrosion because of the corrosion resistance of tin itself, because of the ease of solution in lead to form a corrosion withstanding solid solution, and because of the proximity of the two metals in the e.m.f. series. 10. Antimony added to lead decreases its resistance to corrosion because the solubility of antimony in the lead crystals is too little to counter-balance the presence between the crystals of considerable amounts of antimony, which being well removed from lead in the e.m.f. series, promote local galvanic action. 11. Pure lead exhibits a laminated crystalline structure. The number of crystals showing this structure as well as the regularity of the laminations decrease with the addition of impurity. The attack on pure lead crystals consists of dissolving off layer by layer."

Protective Covering Is Recommended

It will therefore be observed from the above conclusions that pure lead with a percentage of tin would be the best lead cable to lay in the ground, as it is the most resistant to corrosion. The writer has in the last few years had considerable experience in using buried cable and has no hesitancy in recommending the following method as the best known at this time. The trench having been dug to the required depth, say 18 inches, the bottom is smoothed off and covered with about 1 inch of soft sand. Strips of roofing or tarred felt paper (the latter preferred) about 6 or 8 inches wide, varying according to the size of the cable to be laid, are then laid on the sand bottom. Hot Ever-protect cable compound is then poured on the roofing paper from a kettle. Before this has had time to cool off other men lay the cable on the paper, while others lap the tarred paper over the cable, to which it will adhere. The cable is then covered with 2 or 3 inches of dirt and allowed to cool. The cable should not be placed on the compound when it is too hot, but just as it is commencing to cool off. All splices should receive a generous coating of the compound. Before filling up the trench a board wide enough to properly protect the cable and not less than 1 inch thick, creosoted if practical to do so, should be placed. The object of this board is to arrest the attention of any excavator who might be at work without the knowledge of the telephone manager. Another method of laying cable in the earth is to make a V trough of two wooden boards, line it with tarred paper, fill with Ever-Protect compound and lay the cable in this trough. A board is then placed on top. However, this is almost as expensive as fiber or pump log ducts, which are much preferred to the other method, cost being equal.

It is well to remember in considering the advisability of placing cable directly in the earth that it should only be done where the use of clay ducts or fibre are not feasible or practicable. The reason for this is that cable laid directly in the earth is not as flexible as when laid in conduits and is much more liable to injury. These are the only objections which the writer has ever heard expressed by competent engineers. Nevertheless, buried cable has come to stay and has a very definite value in the construction or re-construction of small plants. If buried cable had only an average life of ten years, the writer believes that it would have paid for itself in reduced cost of maintenance and annoyance to subscribers.

Having decided on installing cable in this manner, one must be careful to anticipate future growth and allow a substantial margin of vacant conductors; probably double present needs. In making crossings at streets where the traffic is heavy, care should be taken to protect the cable against the load. This may be done by bridging with heavy timbers such as railroad ties or four by four lumber. It would appear that in order to prevent corrosion of the lead sheath some separator must be used and the writer does not know of any flexible separator more efficient than the Ever-Protect cable compound which is manufactured by a company at Mitchell, Ind. It is true that a clay or fiber separator is an effective separator, but the expense of these separators is beyond the means of the average small telephone owner.

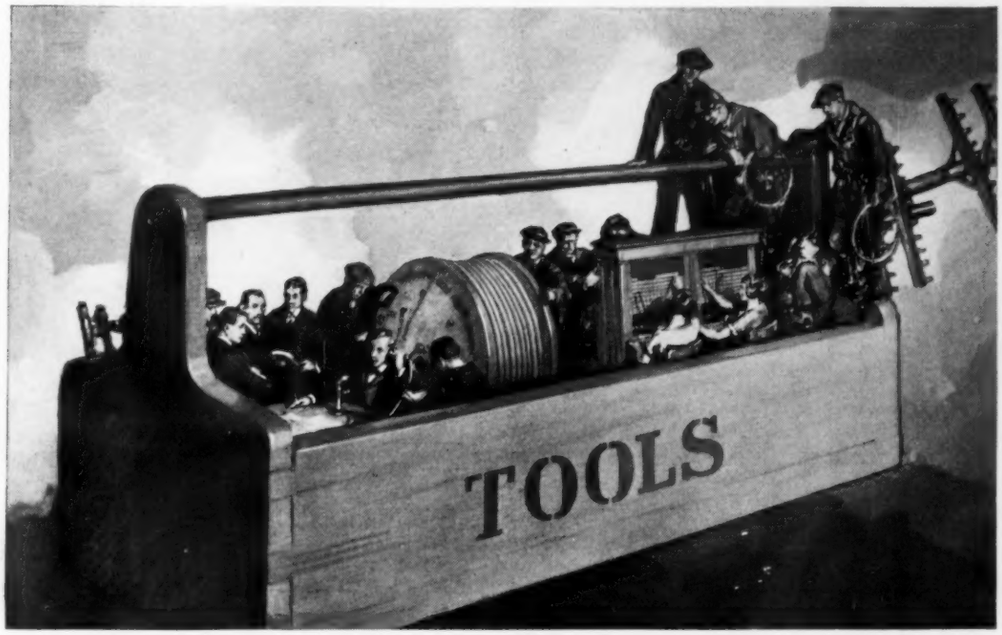
The Ever-Protect compound adheres well to the lead sheath of the cable and apparently possesses no chemicals which would in any way injure the sheath. Its exact composition is a secret but it resembles very much the compound which was named "Ozite," used for filling and splicing cable 25 years ago. However, the present compound seems to be a very great improvement over "Ozite" and much more pleasant to handle. It will pay to use the compound generously as the thicker the layer the better the protection from corroding substances.

While the tests conducted by the Purdue University seem to prove conclusively that lead with a small percentage of tin is preferable for cable laid in the ground, the writer has had a strong leaning toward pure lead but has had no opportunity of seeing or making experiments to determine the truth of this theory other than that history tells us of lead coffins having been dug up after having been centuries in the ground and showed no deterioration whatever.

Where the underground cable is brought up to the distributing poles, it should be protected by galvanized tin or brought up through an iron pipe with a 90-degree bend below the ground. The protection should be extended up the pole not less than 6 or 7 feet. It has been the practice of the writer to avoid splices under ground as far as possible. In the case of end poles the use of a tail at the terminal has been dispensed with and the main cable is taken straight into the terminal. All cable work should be constructed on the basis of a metallic circuit for each subscriber and in the case of buried cable it might be well to lay a cable having twice the capacity of the present requirements of the territory to be served.

The question of locating trouble in buried cable is a very much discussed subject, but the writer does not believe it is any more difficult or complicated than locating trouble in any other cable and practically the same methods should be used. Where the exploring coil is used for this purpose, a small hole may be dug carefully around the buried cable and the usual test made as in aerial work.

*This was apparently the cause of corrosion in case cited by the author.



The Tools of National Service

The American people lead the world in the efficiency of industry. Who can say what part of their success is due to the superior implements they use. This much we know. They have the world's best telephone system as an instrument of communication, and they use it without parallel among the races of the earth. To this end our telephone service must be equipped with proper tools.

The tools of management. Bell System executives, rising from the ranks of those who know telephony, must share our responsibility to the public, most of whom are telephone users, shareholders or workers.

The tools of service. The national, two-billion-dollar Bell System, handling fifty-eight million telephone calls a day, must be enlarged and extended while in use.

The tools of forecast. We must continue to know the rapid and complex growth of communities and make provision in advance, so that the telephone will be ready when needed.

The tools of supply. The Western Electric Company, our manufacturing and purchasing department, its factories manned by 40,000 workers, assures us that extension of facilities need never be interrupted.

We must have the best tools of finance, of invention, of everything else, in order to continue serving the American people.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
BELL SYSTEM
One Policy, One System, Universal Service

Sleet Lays the Lines in Ruin

A Swath of Destruction is Cut Across the Central States by a Multi-Million Dollar Sleet Storm — Illinois Bell Alone Suffers Million Dollar Loss — Repair Details

Here are some of the sad sights in the Illinois Bell territory following the record-breaking sleet storm. At the left, a scene in Alton, Ill. At the right, ruin in Springfield, Ill.

A vivid survey of the immensity and severity of the December sleet storm which laid low many of the telephone lines in the central west has been made by the Illinois Bell Telephone Company for publication in that company's house-organ, the News. The larger companies' resources and emergency adaptability worked wonders in repairing the devastation, but in the cases of many of the smaller companies, only temporary repairs could be made, and even these after extreme effort. In some instances the storm put companies so completely out of business that the work of rebuilding has not been tackled.

In its resume, the News says:

Gentle rain falling with but a slightly greater intensity than that of a summer shower and accompanied by a freezing temperature for two days, December 18 and 19, 1924, made a path of sleet over 100 miles wide from Chicago to St. Louis and, in the Illinois Division alone, demolished plant of the Illinois Bell Telephone Company the replacement of which will cost at least $1,000,000. The total damage to plants of connecting telephone companies probably will run into even larger figures. The sleet storm was followed immediately by a drop in temperature to ten degrees below zero or in many cases even lower, which made rehabilitation extremely difficult.

The storm which has been characterized as the worst in any area of the size in the history of the industry caused almost complete destruction of the lines in the worst affected areas due to the thickness of the sleet and the heavy icicles hanging from the wires and the following cold weather which froze the fallen wires into the ground and made salvage all but impossible.

More than 23,000 Illinois Bell poles were broken down in the Illinois Division and in the center of damage, Springfield, Decatur, Alton and Bloomington, hundreds of drops and few cables were down.

The Long Lines Department of the American Telephone and Telegraph Company lost about 3,500 poles in Illinois and suffered a monetary damage of about $350,000. In the Suburban Division neither the extent nor the damage of the storm was as great. Most of the trouble consisted of scattered pole breaks and the number of poles down totaled about 1,200. The Chicago City Division suffered no damage.

Property damage other than telephone was proportionately great. The other public utilities using overhead wires suffered heavy damage and in many places shade trees which had added to the beauty of the cities in which they grew, and fruit and shade trees in the country were denuded of their upper limbs and branches, or totally destroyed. Roads were littered with branches, poles and wires in tangled and frozen mazes. Electric power and trolley wires were in many cases mingled with telephone and telegraph wires. The usual hazard of fallen power wires was minimized due to the splendid co-operation of the power companies which cut off their current as promptly as practicable.

Storm Area Extensive

Outside of Illinois the path of destruction extended eastward over the southern tip of Michigan, the northern tip of Indiana and a small strip in Ohio reaching about as far as Toledo. Southwest the storm affected Missouri, Oklahoma and Texas. But the worst destruction was in Illinois and Missouri. Long Lines lost a total of about 6,000 poles, including the Illinois losses and $600,000 damage for the system. The losses of the Southwestern Bell Telephone Company in Missouri were almost as severe as for the Illinois company, but were tempered by the fact that the concentration of plant is not as great.

Repairs Begun Immediately

Despite the extreme cold following the sleet damage, repairs on the lines began almost at once. Telephone communication with headquarters was impossible for the first few days, but as the extent of the damage became known supplies were rushed to the points affected and later, as communication was established, more supplies, if needed, and gangs of men were sent. The general plan of reconstruction was first to put up every second pole in a temporary manner and then run through four wires; second to complete the temporary repairs, put in the remaining poles and the normal number of circuits. This placed the lines in a safe condition so that permanent reconstruction might be done under better conditions and without undue cost.

The forest primeval moves to Main Street

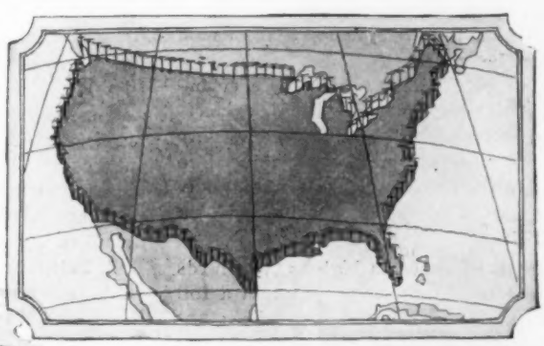
THE telephone and electric light poles which stand along your streets were not long ago lofty trees growing in a distant forest.

These poles, cut under scientific forestry regulation, are made available for your service by the Western Electric Company. This Company supplies telephone and lighting companies the country over with poles and with the many materials needed to equip those poles.

All this in addition to the fact that Western Electric is a maker of telephones that have long been the world's standard.

A hurry call for poles. In emergencies like this, Western Electric stocks of poles and equipment help materially in the quick restoration of public service.

Everything from the bottom of the hole to the top of the pole, including a machine to dig the hole—Western Electric backs up the public utilities with all manner of supplies.



If all the poles delivered by Western Electric last year were placed in line, they would reach all way 'round the U. S.—with only 37 feet between poles.

Western Electric

SINCE 1869 MAKERS OF ELECTRICAL EQUIPMENT

It's easy to believe the storm cost ran into millions when you view these tangled, sleet encrusted wires that brought line gangs from associated Bell companies in many parts of the country, to help their Illinois Bell brethren.

Plant Damage Very Great

In Springfield and Alton the exchange plant was seriously damaged. Poles, cables, wires and terminals were down in the streets and a large number of subscribers' lines were out. In Springfield there were over 4,000 lines out due to broken cables and wire. In Alton there were almost 1,000 lines out due also to broken cables and wires. In fact the destruction was so great that it was impossible to restore the lines to their former state. During the past year a heavy construction program had been carried on and the wires and cables which were broken in Alton by the storm were among those which it had been planned to replace with new construction. So instead of replacing the old plant temporarily the new construction plans are being speeded up and the damaged plant is being replaced with new cables. This will take more time but when service is restored in that manner it will be in a high class, permanent shape. Reconstruction in other cities also involves general plans which must be considered in a broad way. This type of construction is slower and requires much more detailed engineering and planning and a much more complicated assemblage of material so that work in the cities has necessarily not moved so rapidly as the work on toll lines.

In many cases as high as two-thirds of the total number of poles in a toll lead were down. And even this is not a good measure of the extent of the damage, for in many instances the weight of ice would strip the wires from the poles, which would be left standing. On the Peoria-Springfield line, consisting of approximately 3,000 poles, sixty-five per cent were down and on some of the shorter leads even a higher percentage succumbed to the storm. The 730-pole Mason City-Lincoln line lost eighty per cent; the Beardstown-Springfield line of 1,740 poles, seventy-five per cent; the Virginia-Jacksonville line of 700 poles, seventy per cent; the 1,350-pole Springfield-Taylorville line, sixty per cent; and other lines smaller percentages down to the Champaign-Decatur line of 2,100 poles of which twenty per cent were out.

The principal damage to Long Lines leads was on the Chicago-St. Louis line where 3,000 poles were down, principally between Springfield and St. Louis.

Linemen Borrowed

Restoration work was begun as quickly as men and materials could be rushed to the scene of the breaks. Men were borrowed from the two other divisions of the company and from six associated Bell companies. Equipment was loaned by the two divisions and three of the associated companies. The detail from the Chicago Division consisted of sixty-three men, including six gangs and seven line foremen and eight construction trucks under the supervision of H. C. Courson, district line foreman; the Suburban Division sent 140 men and twelve motor trucks under the supervision of Harry J. Lewis, district construction supervisor, and W. S. Wilson, supervising foreman. The more than 300 men from the associated companies included a detail of ninety-seven men from the Bell Telephone Company of Pennsylvania under the supervision of General Foreman Hasskarl and Supervising Foremen DeHaven, Brane and Crossland, which consisted of fifteen line foremen, seventy linemen, four clerks, garage foreman and three mechanics, accompanied by fifteen trucks and three Fords. Seventy-six men came from the New York Telephone Company under the supervision of Foremen Cherry and Allen and included ten line foremen and sixty-four linemen. The Ohio Bell Telephone Company sent fifty-six men under Foremen Kuhn and Rosse, including two timekeepers, eight line foremen and forty-four linemen accompanied by an earth boring machine. From the Chesapeake and Potomac Telephone Company came fifty men under the supervision of Foremen Thompson and Cavendish, including eight line foremen and forty linemen. The Wisconsin Telephone Company contingent consisted of Foremen Davis and Horton, two truck drivers and twenty linemen accompanied by two trucks. From the Indiana Bell Telephone Company came Foreman Chew, six linemen and three groundmen.

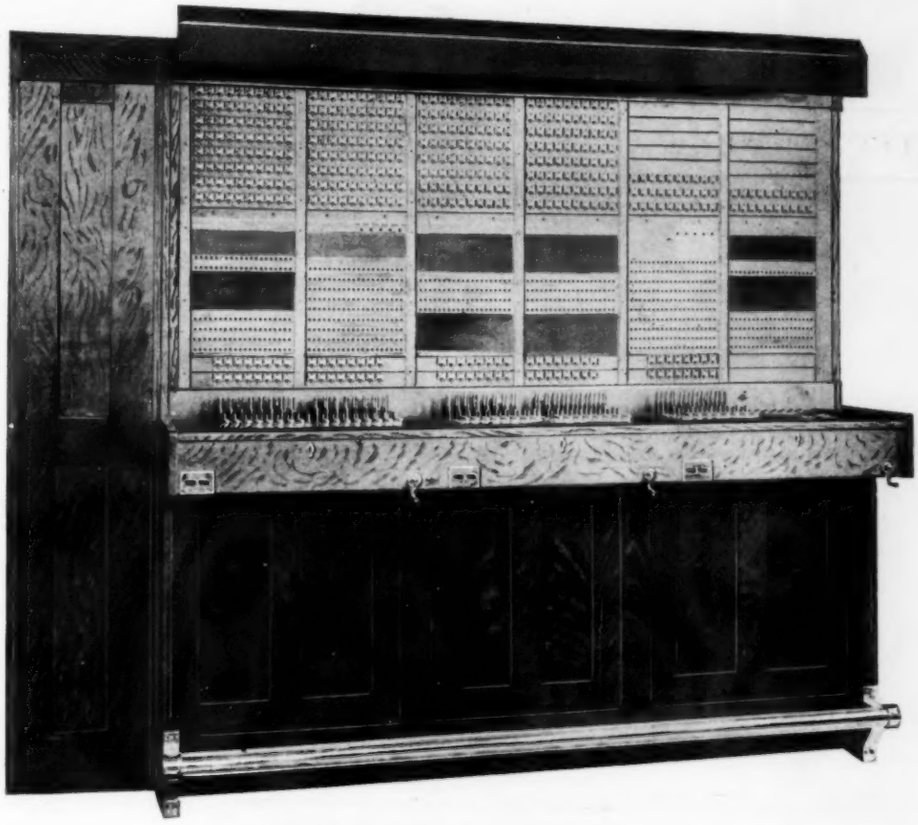
Too much cannot be said in appreciation of the work and spirit of these men who left their homes and came in to share in the work of restoring service under the most difficult conditions.

Supplies from the Western Electric Company were in many cases expressed to the points immediately needing material. The major items of material included 900,000 pounds of copper wire or an equivalent of 5,200 miles, 11,000 poles, 10,500 cross arms and fittings and 200,000 feet of cable, mostly fifty pair.

Praise for Linemen

Too high praise for the supervisory forces, line foremen and linemen cannot be given. With the temperature well below zero these men forgot about hours and labored from daylight to dark, in many cases starting out for work in the morning before daylight, so as to be at the break and on the job at sunrise, and the work went on seven days a week until service was restored. In several cases men with frozen feet or hands, after receiving medical attention refused to stay at home, but insisted on coming back to the job and doing what they could.

By Saturday, January 10, eighty per cent of all the toll lines were restored and practically all of the balance are working by this time.



RESULTS!

What does it matter to a subscriber in a small town whether he turns the crank to get central or takes the receiver from the hook—providing in each case central answers just as quickly.

With the old style magneto switchboards, speed of service depended too much on one operator's ability to answer calls coming in her position as her fellow operators were practically unable to assist conveniently, and perhaps the call required trunking too.

But with the Leich Magneto Multiple Switchboard, any operator that is not busy takes the call and completes it so service to the subscriber is exceptionally fast.

With the new lamp supervision on Magneto Multiple Switchboards the supervision problem has been quite satisfactorily solved.

—and Leich Magneto Multiple Switchboards require no change in station equipment or rebuilding of outside plant.

A good sound investment that will guarantee regular dividends.

LEICH ELECTRIC CO.

Telephones, Switchboards, Accessories

GENOA, ILLINOIS

DISTRIBUTORS

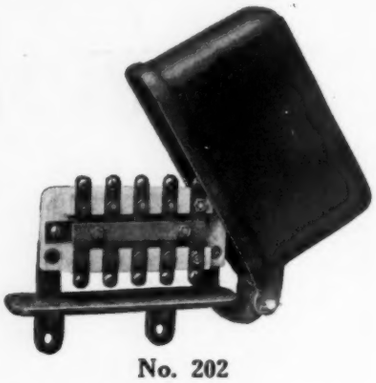
ELECTRIC APPLIANCE COMPANY
Chicago, Dallas, San Francisco, New Orleans

ST. PAUL ELECTRIC CO.
St. Paul, Minn.

POST GLOVER ELECTRIC CO.
Cincinnati, Ohio

B-R ELECTRIC COMPANY
Kansas City, Mo.

PROTECTS CABLE



No. 202

PROTECTS SERVICE

The use of No. 202 CROSS ARM LIGHTNING ARRESTERS has become the standard practice of hundreds of operating companies.

Plant men find that No. 202 drains static from open wire leads and prevents damage to cable and station equipment.

Self-Cleaning Sawtooth construction of No. 202 keeps the lines clean and in continuous service.

Reliable Electric Company

3145 Carroll Avenue Chicago, Ill.

Universal Truck with Fordson Power Making Hit!

Chicago, Ill.—The Universal truck, which was first shown at the Chicago Auto Show in 1924, has proven itself during the past year. It is constructed of the finest parts obtainable, such as Timken axles, Cotta non-shippable transmission and Spicer joints. The chassis cradles the sturdy, durable and economical Fordson, in a three point suspension. Radius rods with adjustable bearings and flexible mountings, while found on only a very small percentage of 2½-ton trucks, are standard equipment in the Universal.

The installation of the Fordson power plant is simple and can be accomplished in an hour's time. Delays necessitated by sending to the truck maker for parts are eliminated, as Fordson parts are immediately available everywhere at a cost of about 10% of the cost of similar parts for other trucks—in fact, new motors can be installed for considerably less than other truck motors can be overhauled for and no time need be lost, the Universal makers state.

Many letters from satisfied users, telling of hauling 4 and 5 tons under the worst road conditions possible, are cited as proof of the power of the Fordson installed in the Universal. Pulling a carload of coal weighing 87 tons up an incline is what a 2½-ton truck is not ordinarily required to do, but it was accomplished in the coal yards of the Moweaqua Coal Mining & Mfg. Co. Moweaqua, Ill.

With a purchase price from $800 to $1,500 less than other trucks of equal capacity and available service at any Ford dealers, the Universal offers the most efficient hauling service—a service where the initial, operating, depreciation and maintenance cost are at least 33⅓% less than that of the average truck, so the sponsors claim. An evidence of what the Universal will do, J. I. Randolph of Rimersburg, Pa., writes:

We can truly say that we have never seen a better built and constructed chassis on any truck of twice its capacity. We believe when you consider the low cost of the Fordson motor in this job, that this truck complete with motor makes up one of the best trucks of 2½-ton capacity that money can buy. We are sure that this chassis is so constructed and built of such good material, that it will last a life of three or four Fordson motors. You know from your experience what service a Fordson motor will render, and that it would be possible to buy a second motor if necessary, and at the same time not have as much money invested as would be required to make a purchase of any other truck of 2½-ton capacity. To assure you that it will take care of its load, will say that on one test we made with same, we loaded the truck with four tons of iron and hauled it up one of the longest and hardest hills in this country, and it did this work very easily."

WESTERN CEDAR POLES
Treated or Untreated
G. W. SLACK LUMBER CO.
Kalispell, Montana
Producers of "Glacier Park Cedar Poles"

CEDAR POLES
NORTHERN + WESTERN
BUTT-TREATING - GUARANTEED GRADES
ANY SPECIFICATIONS REQUIRED
BELL LUMBER CO., Minneapolis, Minn.

A Friendly Tip from H. M. Friendly

Editor,
TELEPHONE ENGINEER,
Chicago, Ill.
Sir:

"On page 40 of the January, 1925, issue of TELEPHONE ENGINEER some alleged historical facts are given relating to Prof. A. E. Dolbear's work on the telephone while at college, prior to Bell's entry. In fact, it states this took place in the middle sixties.

"I have before me a copy of Prof. Dolbear's own book "The Telephone" printed in 1877, wherein the professor, on page 116, in closing a discussion of the Reiss and the Gray telephone and the Bell telephone exhibited at the Centennial Exposition at Philadelphia, in 1876, writes the following paragraph:

"'This was the first speaking telephone that was ever constructed, so far as the writer is aware, but it was not a practical instrument. Many sounds were not reproduced at all, and according to the report of the judges at Philadelphia Exposition, one needed to shout himself hoarse in order that he might be heard at all.'

"The book of Prof. Dolbear illustrates a number of telephone instruments, some using permanent magnets, but none of the general appearance of the illustration in the article referred to. In fact, none are of a type intended to be held in the hand. This proves most conclusively that the statements in the article have no foundation, and moreover is the rankest kind of imposition.

"The instrument Bell and Watson used when the principle of the telephone was discovered was a permanent magnet instrument, though an electro-magnetic one was used and, that kind exhibited at Philadelphia. Prof. Dolbear has been often credited with having demonstrated the practicability of using a small permanent magnet first. Bell denies this. However, the size of the magnet in itself does not constitute invention.

"There appears to have been some feeling in Mr. Bell against Mr. Dolbear about this time, because when Bell addressed the Society of Telegraph Engineers in London, October 31, 1877, he said:

"'The interest excited by the first published accounts of the operation of the telephone led many persons to investigate the subject, and I doubt not that numbers of experimenters have independently discovered that permanent magnets might have been employed instead of batteries. Indeed, one gentleman, Professor Dolbear, of Tufts College, not only claims to have discovered the magneto-electric telephone, but, I understand charges me with having obtained the idea from him through the medium of a mutual friend.'

"The latter statement by Bell appears on page 75 of Prescott's book, 'The Speaking Telephone Talking Phonograph and Other Novelties,' printed in 1878.

"Subsequently, Gray, Dolbear and Edison were aligned with the Western Union Telegraph Company, a forty-million dollar corporation against the then impecunious Bell Telephone Company. The case was settled favorably to the Bell patent. It would not have been, were the facts as they were given out in the item under question in any wise true. The quoted statement in Prof. Dolbear's book in 1877 is its absolute refutation.

"It seems to me that someone with ability, sense of fairness and temerity, who has lived as a telephone man through the active years of the instrument's development might do a great service by compiling a history of the telephone and its commercial rise, telling the unpleasant as well as the pleasant. When such a man rises among us, I will proffer what early literature I have collected for his use. In the mean time, I will be on the look out for more.

"Very truly
"H. M. Friendly."

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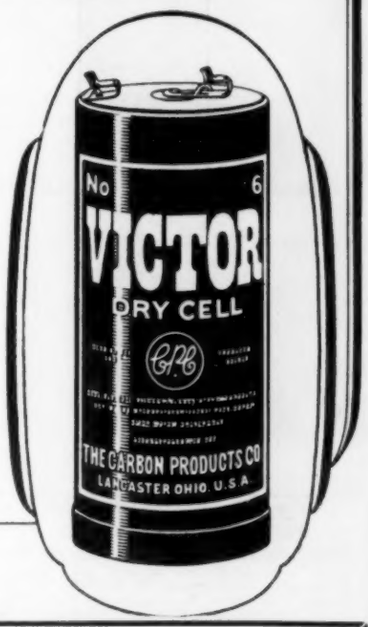

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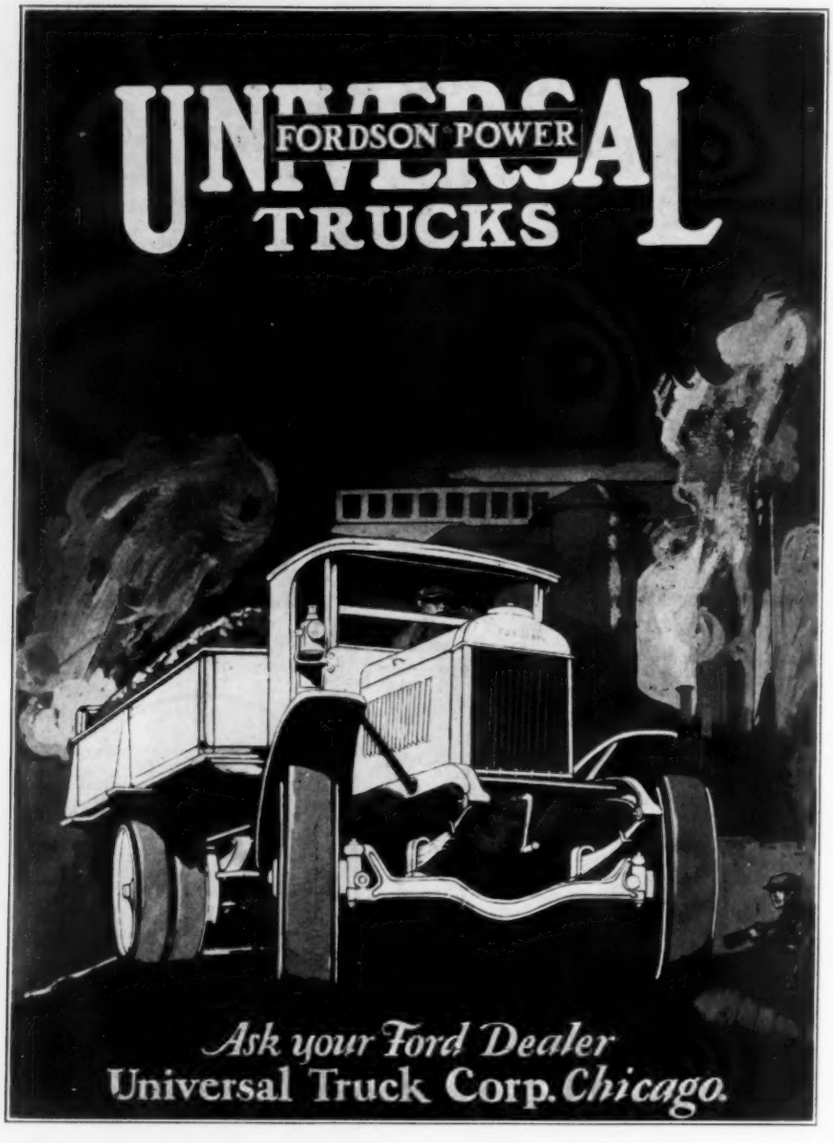

Ohio Bell Inventory Would Take Man 83 Years

Columbus, Ohio—One man working six days a week would require almost 83 years for making a complete inventory of Ohio Bell property, according to George B. Williams, the company's appraisal engineer, at the consolidated rate case hearing.

He said it took 25,951 man-days to make the inventory, which carries no valuations, and 2000 days' use of motor vehicles. He declared the system embraces 6000 miles of toll lines.

Torreon (Mex.) To Build Telephone System

Torreon, Mex.—Figueroa y de la Mora, Calle Valdez Carrillo, this city, have been granted a concession permitting it to construct and operate a telephone system in this city and other parts of the state of Coahuila, for 20 years. It is estimated that from 800 to 1,000 telephones will be installed in Torreon. U. S. Consul Bartley F. Yost reports the new company probably will be in the market for all telephone equipment except poles.

Nebraska Plans Its Greatest Meeting: Lincoln, Feb. 17-19

Lincoln, Neb.—Lincoln Hotel on February 17, 18 and 19, will house the biggest convention in the history of the Nebraska Telephone Association, according to present indications. President C. L. Kelly of North Bend, Field Secretary G. H. Presson, and other officers are putting the finishing touches on the program.

Gives Local Company First Page Boost in Newspaper

Granite Falls, Minn.—High tribute was paid to the service standard and management of the Granite Falls Telephone Company in the local news' story on the annual meeting. K. E. Neste was re-elected president of the company. G. L. Wilder, manager, was credited in the story with being primarily responsible for the excellent service.

Buffalo, Mo.—F. W. Schwalm and Thad Dunaway of Eldorado Springs, Mo., have bought the Buffalo Telephone Company from W. L. Morrow and others. The recent storm put the plant out of commission for a month. Rebuilding now is being done by the new owners.

Omaha, Neb.—Approximately $6,000,000 will be spent by the Northwestern Bell Telephone Company for improvements and extensions in 1925.

J. K. JOHNSTON
Telephone Engineer
903-4 Lemcke Bldg. Indianapolis, Ind.
Has appraised exchanges as follow: Arkansas, 2; Florida, 2; Illinois, 8; Indiana, 219; Iowa, 5; Kentucky, 21; Michigan, 20; Missouri, 2; New Jersey, 2; New York, 2; North Carolina, 6; Ohio, 71; Pennsylvania, 23; South Carolina, 4; Tennessee, 12; Virginia 11; Total, 410.

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LINE AND DESK

HOW LOADING COIL CORES ARE MADE

In a recent number of "Western Electric News," in an article on the "Manufacture of Loading Coils," by R. D. Jessup, appeared the following interesting description of the process of manufacturing the new pressed iron cores which now are used in loading coils:

A loading coil consists essentially of two parts, a core of iron and windings of copper wire. The best cores for loading coils were formerly made of a special grade of hard drawn iron wire. This was coated with lacquer and wound on forms into cores of the required cross section, which were then taped. A more recent invention substituted a pressed iron-dust core, giving even more satisfactory results at lower cost and placing the entire control of this important material within the manufacturing department. Nearly all of our loading coils now have this type of core and the process of manufacture is carried on at Hawthorne in a separate department under very careful supervision.

The first step in this interesting process is electro-depositing the iron. The plating or electrolytic method of preparing the iron is used, because the plated iron is comparatively pure and the structure is such that it is peculiarly suitable to the subsequent crushing and grinding process. In electroplating, the plating material (in this case iron) is removed by the electric current from plates or bars, termed anodes; 2nd, transferred through the medium of the plating solution, called the electrolyte, to the part to be covered, known as the cathode. The electrolyte is contained in a tank, usually wooden, and in it are suspended the anodes and cathodes, which are connected in the circuit of the plating generator, which supplies the current. In an ordinary plating room the anodes cathodes might be telephone parts, would be nickel, silver, etc., and the silverware or other articles to be plated. The anodes for producing electrolytic iron are cast steel plates 39" long by 27" wide, weighing about five hundred pounds each, and the cathodes are made of ⅛" boiler plate of approximately the same area.

About two weeks are required with a continuous current of 3,000 amperes to produce a deposit of iron about ¼" thick on the cathode plates. At this stage the plates are removed and the cathode iron is stripped off. It is then partially crushed in a hammer mill crusher, after which it is placed in ball mills and ground to a fine powder, called ball mill dust. Before it is ready to press, the ball mill dust is tumbled with zinc and then in a different tumbling mill with a small quantity of shellac. This gives the necessary insulation to the grains and serves as a means of controlling the magnetic properties of the finished cores. After the powder comes from the final tumbling it is air dried until quite dry and is then ready for pressing.

The two big steam hydraulic presses are of a special design, quick acting and giving pressures as high as 3,000,000 pounds, which is ample for pressing the largest cores now required.

The development of moulds to withstand the enormous pressure (for most cores about 200,000 pounds per square inch) has been a serious problem. Only the very best grades of special steel are used and great care is required in hardening and grinding.

In pressing cores a small filling fixture is used, which measures out the right amount of dust and distributes it evenly in the mould. This insures a core of correct size and uniform density. The press is controlled by the operator, who sits on the low stool in front of the control lever and pressure gauges. When the mould is in place he moves the lever forward, which admits steam and actuates the press. When the right pressure is reached as indicated on the gauge, he pulls the lever back, clothing the steam valve and releasing the pressure.

The usual Hawthorne safety standards are observed here. The high pressures sometimes break the moulds, and in order to eliminate the danger from flying pieces, a special guard has been devised. The forward movement of the control lever drops this guard around the mould, where it stays until the lever is pulled back.

The pressed dust rings when removed from the mould look like solid iron rings, though of course they are not nearly so strong. They compare in strength with wooden rings of like size and give no trouble due to breakage in subsequent operations. They are baked to remove all traces of moisture, de-magnetized, baked again, then dipped in a shellac solution and dried, after which they are inspected as a last step before going to the loading coil department.

WHAT HAPPENS WHEN A STEEL KNIFE IS PLACED ON TOP OF THE TELEPHONE?

Every state seems to have one county which is classified as a backwoods community. In Indiana, Brown county bears that distinction and many stories are current of the sayings and doings of the natives of that particular political division of the Hoosier State. In a recent issue of the Indianapolis Sunday Star appeared a feature story under the caption, "Down in the Hills of Brown County," and among other things the reporter told of an interview with a former operator of the telephone exchange in the quaint village of Nashville which is the county seat. It seems that, among other things, they have a peculiar kind of telephone line in Brown county, if the story is to be believed. The former operator is quoted by the reporter as follows:

"Sometimes a piece of steel placed on the top of the phone box, like those used in the Nashville section, will cause the voice to carry extremely well over the wires to and from that one specific phone, while the others would be thrown partially out of commission.

"I suggested to the manager that something like the above might be going on somewhere on the lines and he promised to make an investigation, adding that he would advise me if he found conditions as I had predicted. He visited the homes of a number of subscribers who had nothing but complaints for him, but when he came to 'Mrs. Probe,' she assured the boss-lineman that her phone was working very good. He glanced around and spied a piece of a steel knife on top of the phone box, and after he had removed it, advised the woman that that was what was causing the trouble. Of course, she pretended not to know it was there."

The picture that accompanied the story was that of a not unmodern magneto

switchboard and this has led us to wonder just what variety of telephones is in use. Back in the days when we spent many of our hours in urging an easy-going nag over miles and miles of unimproved highways in pursuit of the elusive trouble on magneto farm lines, we always found that a piece of steel on the top of the telephone grounded the line so that not even the offending telephone could be used.

USING 60 CYCLES FOR RINGING CURRENT—QUERY.

"Line and Desk" is asked to give its opinion in answer to the following query: "We have been using power directly from the lighting circuit for ringing in our exchange. The lighting circuit is 25 cycles and it has worked very well. The power company has notified us that it will change over its system to 60 cycles. What we want to know is if we can use the new current for ringing as we have been doing."

We have known of a number of exchanges that used 25-cycle current direct from the 110-volt side of the transformers and have found that it works very well for ringing purposes. A number of traction lines have used 25-cycle alternating current in the past but some of them are changing over to 60 cycles. When this change is made it no longer is possible to use the lighting current for ringing, as the frequency of the alternations is too high and the ringers do not respond well enough to give clear rings. It is possible to use lighting circuit current by the use of a frequency converter outfit that will change the 60-cycle current to about 16 cycles, which is the common ringing frequency. The apparatus for doing this is quite simple and is inexpensive to oprate. We can give you the address of its manufacturers.—Staff Contribution.

Our Technical Editor Enters the Operating Field

R. V. Achatz, who is known to our readers as the technical editor of this journal, has returned to the telephone operating field after a number of years of teaching at Purdue University. Since 1913, Mr. Achatz has been connected with Purdue, where he has been teaching courses in Telephone Engineering, Radio Communication and Engineering Administration. In addition to this work he has developed an extensive contact between the university by extension work among the telephone companies of Indiana. For the past three years he has been technical editor of TELEPHONE ENGINEER and, during summer months, has done a considerable amount of consulting engineering work for various telephone companies. Last June he found the burden growing too heavy and a rearrangement of his work at the university was made so that he no longer gave time to the teaching work but retained a connection with the Engineering Experiment Station and Engineering Extension Service.

In the process of refinancing of the Southern Indiana Telephone Co., of Aurora, Ind., Mr. Achatz acquired a financial interest in the company and has been made secretary and operating executive. His headquarters now are located at Aurora, Ind. The Southern Indiana Telephone Co. is a prosperous property, operating in the cities of Lawrenceburg and Aurora, Ind., with a toll line system covering part of several counties in southeastern Indiana, contiguous to Cincinnati, O. At the present time, Mr. Achatz is engaged in making a development study of the cities as a basis for extensive additions to plant that are contemplated.

Our readers will be glad to learn that the connection of Mr. Achatz as Technical Editor of TELEPHONE ENGINEER will not be changed by his new venture.

Wm. E. Bell, a Chicago Bell Pioneer, Is Dead

William E. Bell, a member of the Chicago Telephone organization since 1890, died at his home in Chicago, Feb. 9.

Mr. Bell was born in Montreal in 1856 and came to Chicago in 1872. He became district superintendent of the American Telephone & Telegraph Co. and played an important part in developing the leased wire service of newspapers and brokers. He was president of the Theodore N. Vail chapter of the Telephone Pioneers of America.

Buys Bell Property in York County, Pa.

York, Pa.—The York Telephone & Telegraph Company, which operates exchanges in the city of York and in various near-by boroughs in Pennsylvania, and in Maryland, with a total number of stations of 11,646 has bought from the Bell Company of Pennsylvania exchanges at Cross Roads, Airville and Delta in York county, in which places the York Company does not operate an exchange.

As soon as the telephone patrons of York County receive universal service, no doubt it will be necessary to make some adjustment of rates in the York Company.

J. K. Johnston, telephone engineer of Indianapolis, Ind., is making a detailed appraisal of both the York and the Bell property.

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A Reliable Open Line Test

A Satisfactory Testing Method for Location of Open Lines Makes the Wire Chief's Job Easier.—A Canadian Contributor Tells of a Method He Has Used Successfully

By E. R. COLLINS

Wire Chief, Manitoba Telephone System, Brandon, Man.

Testing open lines broken by frost in the winter months, when roads are blocked with snow, is a very important part in testing toll lines. There are several methods in vogue for doing this, but the most general seems to be the capacity test with a voltmeter.

Suppose a line is open at some point, and the ordinary voltmeter is connected to the line with a key so that battery may be sent out on the line to charge the capacity and the discharge allowed to flow back through the voltmeter, a small deflection of the voltmeter needle will be observed. This deflection will depend on the length of wire and the voltage used. This is illustrated in Fig. No. 1.

We will suppose A represents the good and B and C the bad wire of a toll line, and that they are clear of ground. And let us suppose that A is 36 miles long, and we wish to determine the length of B. First an open plug should be inserted in the distant office at M. Then by charging and discharging the line A we obtain a deflection of 8 on the voltmeter. The operation is repeated for B and a deflection of 6 is obtained. Then it follows that:

8 degrees deflection..... 36 miles
1 degree deflection..... 36

8

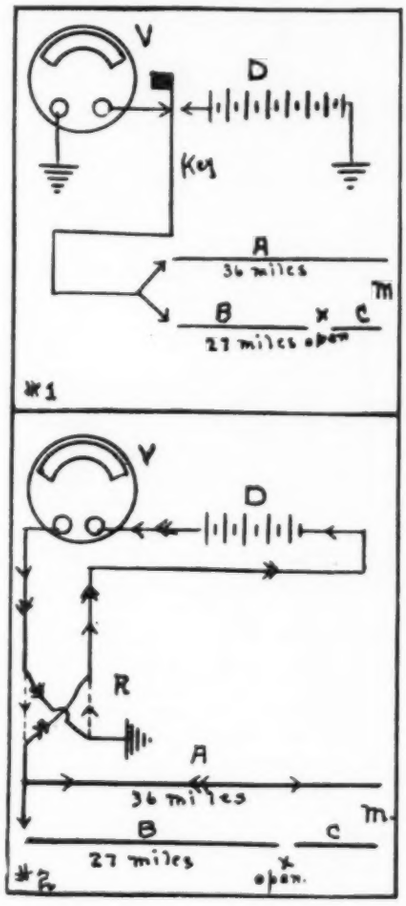
6 degrees deflection.....6x36

8= 27 miles

The above method works out all right, except that the deflection is only momentary, and several operations must be made to obtain a correct reading. The frequency of the charge and discharge also cause a difference in the deflection of the voltmeter. Another objection is that the value of one point of deflection in miles is relatively high, and an error in reading of one degree will possibly mean a 4 or 5 mile of a dirty drive for the troubleman.

The method used by the writer is illustrated in Fig. 2.

Again, A represents the good and B and C the bad wires of the toll line. M is the opened end at the distance exchange, V is the voltmeter, D is the battery, say 50 volts dry cells, and R is a reversing key in the test desk. When the test plug is inserted in the line current will flow out and charge the line as shown by the single arrow, causing a deflection of the voltmeter. Then the reversing key is thrown, and the line discharge as shown by the double arrows. The discharge current is caused to flow through the battery and voltmeter in the same direction as the charge current, and at the same time will give a larger deflection. Now if the reverse key *is operated quickly* back and forth, the needle of the voltmeter will give an almost steady reading.



It follows then that if we substitute some automatic means of reversing the current we can obtain a steady deflection for an open and at the same time a yet larger deflection, as we are taking advantage of the discharge current and plus the charge current.

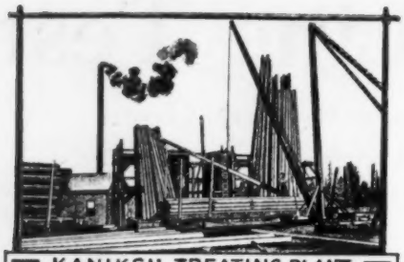
A No. 84-D Western Electric Interrupter stripped of its condensers and resistances, makes a very good reversing device. Fig. 3 gives the complete wiring diagram for using the interrupter. Best results will be obtained by adjusting the speed of the interrupter, at the point where the voltmeter needle ceases to vibrate. It is not advisable to make it run any faster, as the lowest frequency that will allow the needle to remain steady, gives the best results.

The writer uses a 50-volt 10,000-ohm Weston voltmeter with a 50-volt battery. Each division up to 30 volts has been redrawn, making 4 divisions for one volt, so that a reading of 30 volts gives an open reading of 120 divisions. This works out at about one mile of No. 10 B. & S. copper for each division. However, there is a falling off in the value of these readings of about 10%. Very accurate results have also been obtained, using a 12-volt Perguolit voltmeter with 50-volt battery.

The test is not limited to physical lines animating in the testing office, but may be used in a number of ways. We will suppose it is desired to test an open at X, as in Fig. No. 4, and that a phantom line is available from A to B. It is not advisable to try and use the phantom, as the impedance of the phantom coils introduce losses that spoil the value of the reading. It is necessary, therefore, to have the phantom coils plugged out, at A and B, and first take an open reading as far as Exchange C. This should balance for both wires to C. Then take the reading of the line in trouble to X and D and work out the value on the short sections.

As another example of its use, let us suppose that the line from C to X is open and grounded, but the section from X to D is clear. Then take the value of line C to D of the good wire with an open plug in at D. Next have a short circuit plug inserted at D and take the reading on the good wire. This will give the value of D to X.

This open test can be used for a variety of purposes. For instance, phantom lines working through long cables are usually subject to induction from other lines, unless the cable is of special construction. However, by balancing the capacity of the different pairs,



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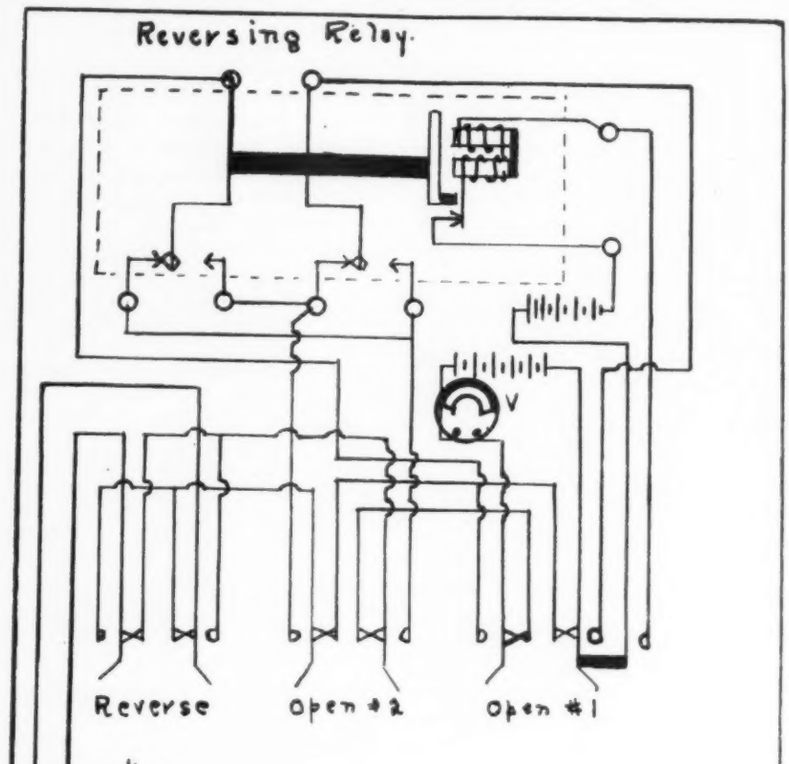
quite a noticeable reduction can be made in the cross talk. Pairs with equal capacity can easily be selected with the open test.

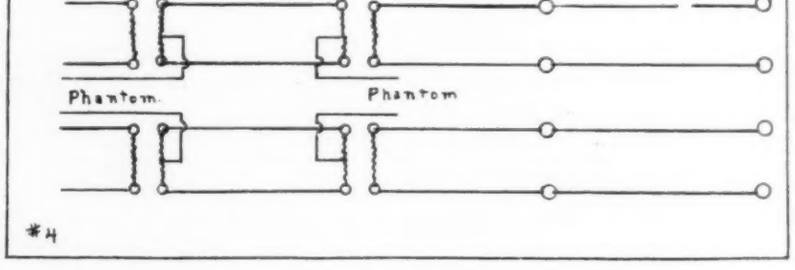
Some condensers are made in different capacities, but in containers of the same size, and from their appearance the capacity would be the same. The gummed paper labels giving the capacity are soon lost. The open test can be used to obtain the capacity of the condenser, and once this is done it is a good stunt to paint the capacity value on the case using white paint and a lettering brush.

Opens in cables can be located within a foot or two. To do this it is best to use a higher battery, say 150 volts, to obtain a higher deflection.

To any who may wish to try out this method I offer this suggestion. Use considerable patience to get the frequency so that the needle just ceases to vibrate. Also make sure that the contacts of the interrupter are striking evenly, and that they make at the same instant. It is also advisable to use a separate operating battery for the interrupter, to prevent as near as possible any change in frequency. Careful adjustment of the interrupter is the secret of success in using this method.

Accurate open tests will save money for your company, make the troubleman happier, and make the toll wire chief more confident.





New Galvanizing Process

Engineers of Indiana Steel and Wire Company Perfect New Process of Galvanizing Iron and Steel Wire Which Is Said to Produce Non-Cracking, Non-Peeling Coating of Zinc

Zinc coatings for the protection of iron and steel from corrosion, especially when exposed to weather, are very old in the art and were first applied more than half a century ago. The oldest type of process and the one most generally used today for galvanizing iron wire is the so-called hot-dip process. In this process the iron is prepared for the dip by making its surface chemically clean and then passing it through a solution of fluxing material. Next it passes into the bath of molten zinc for a brief immersion. In the case of wire the process is continuous and a number of wires are dipped at the same time.

Except for comparatively minor differences in technique, the hot-dip process has been used in substantially the same way by nearly all manufacturers of galvanized iron wire for many years. In all this period there has been little improvement of major importance, although many manufacturers recognized the great desirability of overcoming the inherent defects in certain grades of galvanized wire, more especially those which approach pure iron. The principal defect was a serious one and did much to shorten the life of the wire and retard its use. As well known, this defect lay in the tendency of the zinc coating to crack and peel if the wire were bent or twisted rather abruptly, as when wrapped around its own diameter.

The research laboratory of the Indiana Steel & Wire Co., Muncie, Ind., has discovered a novel and most effective means of overcoming this long-standing difficulty and has solved the problem of producing a non-peeling, non-cracking zinc coating on an iron wire. This is today an accomplished fact and the new process has been in successful commercial production for several months, with most satisfactory

Fig. 1—Showing results from old method of galvanizing (left) and Crapo process (right).

results. The illustration in Fig. 1 serves to show the difference in the adhesion between two wires of the same base stock galvanized under the old and the new process.

Microscopic study of the cross-section of zinc coatings has developed the fact that the structure is divisible into three layers. At bottom or next to the iron there is a layer which consists of a solid solution of zinc and iron which is very high in iron. Directly over this is a layer comprised of zinc-iron alloys and probably a solid solution which is relatively high in zinc. The third or outer layer is substantially pure zinc, although in the case of single-galvanized or tight-wiped wire the quantity of pure zinc is likely to be very restricted.

Naturally the primary object is to put on a coating which shall contain the largest practicable percentage of pure zinc and shall adhere firmly to the iron. Both of these objectives have been obtained in the new process, which is the invention of Frederick M. Crapo, research engineer of the Indiana Steel & Wire Co. Recent investigations have shown that the primary cause of failure in zinc coatings when subjected to bending or torsion strains is the absence of a perfect mechanical bond between the iron base and the zinc coating. The problem of perfecting such a strong bond between the underlying iron and the protective zinc coating is what has baffled investigators and manufacturers from the earliest days of the art down to the present.

The essence of Mr. Crapo's invention is the discovery of a very novel and interesting means for promoting the bond. This consists of giving the uncoated wire a preliminary treatment in a bath of molten salts before it passes into the spelter or zinc bath. These salts contain carburizing material and produce a very advantageous action on the surface of the wire, cleaning it very effectively indeed as well as leaving it in different chemical condition. The chief features of the process are shown in the accompanying figure reproduced from U. S. Patent No. 1,501,887.

The wire is drawn to finished size in the usual way and then it enters the bath A shown in Figure 2, where it is immersed for a few moments in the molten salts. Next it passes in continuous process, through the washing bath B where any adhering salts are removed. Then follows the bath C, where the wire is coated with a liquid flux, such as dilute hydrochloric acid. Thence the wire passes over the hot plate D, where it is dried, and into the molten zinc bath E to receive its protective coating. The wire cools as it passes through the air to the winding

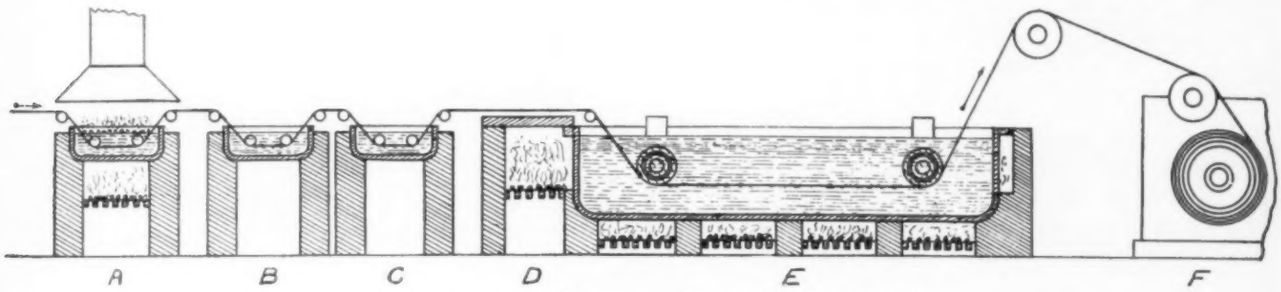


Fig. 2—Route wire follows in Crapo galvanizing process.

reel F, where it is coiled in a bundle ready for wrapping and shipping.

The essential difference between this process and the old type of process is the introduction of the new bath of molten salts, shown at A in the illustration. As a matter of fact the dip in the molten salts can be given to the wire at practically any stage in the process of manufacture, ranging from the rod to the finished wire, but it is convenient to apply it as shown in the illustration. The research department of the Indiana Steel & Wire Co. has made an extensive study and investigation covering the best composition of the salts for the bath A and have also developed numerous mechanical devices which facilitate the practical application of the process under normal conditions of production.

Complete commercial success has rewarded these extended efforts to reduce the new process from a mere laboratory experiment, to a practical mill operation on a large scale. For some few months past this process has been in full commercial production, turning out galvanized wire for varied uses in the electrical and allied industries such as Extra Best Best (E.B. B.), Best Best (B.B.), and Steel Wire and also as seven-wire strand, for many different applications.

Both the physical and the electrical properties of the new galvanizing are of the highest order of merit. Not only can an iron wire galvanized by this process be wrapped around its own diameter without cracking and peeling, but the coating cannot be taken off by any mechanical means except by filing or cutting it away. Furthermore, its electrical properties are excellent because of the very high content in the coating of the purest zinc it is possible to obtain commercially. The bright metallic lustre of the newly galvanized wire as it comes from the mill gives eloquent testimony of the remarkable character of this product. This combined with the perfect mechanical adhesion of the coating to the wire, with all of the ductility and strength which is inherent in pure zinc, demonstrates that the new process is an epoch-making advance in the art of galvanizing.

The Indiana Steel & Wire Co., Muncie, Ind., invites all interested in this type of material to request samples of this wire for examination and test.

Cleveland, Ohio—More than 134,000 persons visited Ohio Bell exchanges during the recent Telephone Week inspection.

J. E. Armstrong Elected Head of Arkansas Association

Little Rock, Ark.—J. E. Armstrong, of Russellville, was elected president of the Arkansas Telephone Association at its twelfth annual meeting. Other officers elected were: E. L. McHaney, first vice-president; George W. Walker, second vice-president, and J. F. Gillespie, secretary.

Practical discussions provided a lively program. A plant department conference lead by E. G. Greber and a traffic session with L. M. Loring at the helm brought out many intimate problems.

R. E. Norris spoke on accounting practices with particular reference to the I. C. C. regulations. P. H. Dillard of the Bell at Little Rock, also gave a practical address on accounting methods.

Percy Redmund, general manager in Missouri for the Southwestern Bell, spoke on the radio situation especially as it effected telephone companies, and later was one of the headliners in the commercial department discussions which were lead by S. A. Lane. L. M. Emmerson outlined a policy for the telephone manager's relations with the social and civic activities in his territory.

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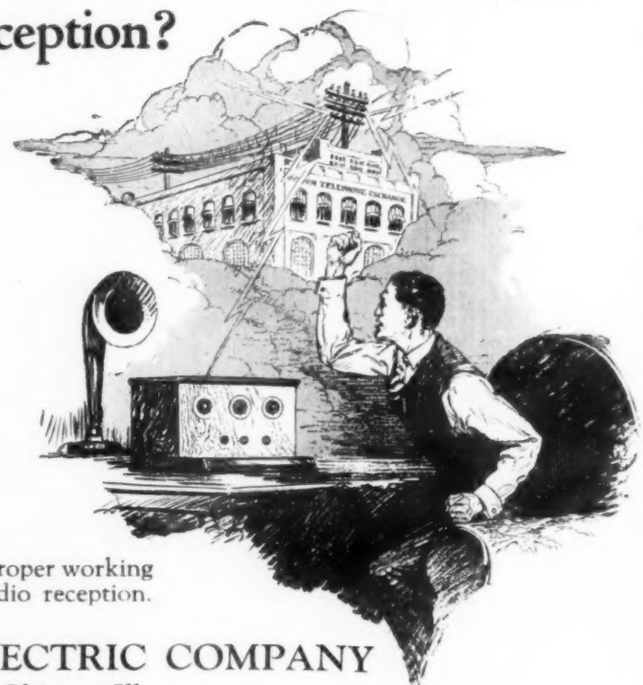

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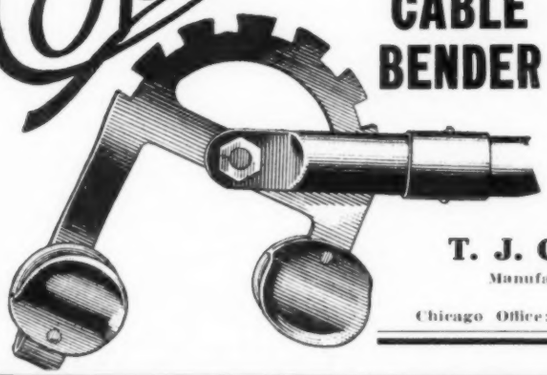

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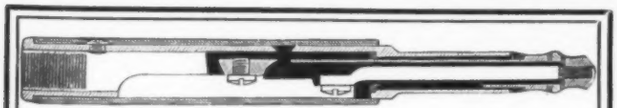

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Our Literary Digest

Review of Recent Publications on Telephony and Allied Subjects

Principles of Transmission in Telephony, by M. P. Weinbach, The Macmillan Company, New York.

Another recent addition to that growing list of excellent text books called the Engineering Science Series, is this book on telephone transmission. Designed as a text book for students in electrical engineering, the treatment is mathematical throughout, but the author has been quite successful in giving reality to the physical concepts arrived at through the mathematical operations. The introductory chapters deal with harmonic functions, complex quantities and hyperbolic trigonometry in a brief manner yet sufficiently complete for the work that follows. The equations of electric wave propagation are then developed in their most general form and the significance of the secondary line constants, the characteristic impedance and the propagation constant with its components, are discussed. The author's treatment is direct and straightforward without employing the sometimes troublesome generalization from special cases or the circuitous method of development found in some books. The discussion is then extended in separate chapters to the infinite line, the short-circuited line, the open circuit line and the line with definite receiver impedance.

In Chapter I by use of the energy transfer concept, the phenomenon of reflections is made more easily understood and succeeding chapter on power relations more clear. Following this are chapters on equivalent circuits, distortion and the inductively loaded line. In the latter chapter the statement that "This scheme was suggested by M. I. Pupin" scarcely gives full credit to the work done by Dr. Pupin. The equivalent circuit method is used to advantage in the treatment of loading. There are short chapters on amplifiers and repeater circuits and a discussion of transmission equivalents closes the book. The author's views on the adoption of the power unit for transmission measurement are interesting and in this connection it may be noted that he states that the volume of sound is proportional to the corresponding current wave (p. 257). A number of typographical errors have crept into the book which will probably be rectified in succeeding printings. Mathematicians may object to the omission of the dot or vinculum to indicate vector quantities but the omission has the merit of simplifying many of the mathematical expressions.

It is unfortunate that a standardized system of notation has not yet been adopted for the quantities entering into telephonic transmission equations, and the use of a and v to represent the attenuation and wave length constants in place of the more usual δ and β adds to the multiplicity of symbols that are in use. Taken as a whole, however —and the reviewer speaks from some experience is teaching the fundamentals of telephonic transmission—the book is by far the most suitable text on the subject that has yet appeared for use in classes of electrical engineering students.

Electrical Engineering, by L. A. Hazeltine, The Macmillan Company, New York.

All who are interested in the training of men for technical work in the telephone industry will welcome this book by Professor Hazeltine of Stevens Institute of Technology. The fundamental principles of electricity and magnetism are the same whether they are to be applied to power, telephone or radio branches of electrical engineering. To the communication engineer, it has not seemed logical to teach these fundamentals in terms of power applications and then to repeat much of the work in specialized courses for prospective communication engineers. The basic course in electrical engineering should be broad enough to cover all of the branches, and if this is the case, the need for specialized courses is not so great. But such a basic course cannot be taught without a text book that covers all branches and such text books have not been available in the past. Professor Hazeltine's book seems to fill the need for advanced students just as the recently published book by Professor Shepardson does in more elementary courses. The material of the text is presented in a very concise way which makes the book more suited for class room work where it can be supplemented by explanations by the instructor, than it is for self study. For the man in the field who finds that the books of his student days do not cover the applications of fundamentals of electrical science to the more recently developed branches, a general reference book is now available and for the college instructor who has a broad outlook upon the field of electrical engineering, is available a text which will enable him to carry that breadth of outlook into the class room.

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